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PRIMARY BATTERIES.

IN referring to primary batteries in our last week's article on the electric lighting of railway carriages, we alluded to the unsatisfactory data generally given concerning the performance of the more recent forms of these generators of electrical energy. We quoted amongst others the battery devised by Mr. O. C. D. Ross, M.I.C.E., which possesses, it is said, none of the usual disadvantages of primary cells. In fact, Mr. Ross claims to employ a totally new arrangement, and that he has left the ordinary beaten track and obtained results hitherto unheard of. We have now before us a copy of a report made on these batteries in August of last year, by Mr. Fred. Ormiston, formerly in the Telegraph Department of the General Post Office. Unfortunately, there is but little of a satisfactory nature in Mr. Ormiston's statistics. We should have been better pleased to know how many cells were used, the working electromotive force, the free potential of the cells, how the circuit was made up, and the ratio of the internal to external resistance, but we are only given the current strength and the size of the jars. The consumption of zinc is stated to have been from 10·95 to 12·75 ounces per electrical horse-power. When an electric lamp is said to give a certain candle power per electrical horse-power, it is understood to mean that that energy is consumed in the lamp itself. Are we to understand from Mr. Ormiston's report that the above quoted consumption of zinc gives one horse power to the external circuit? It is to be regretted that this gentleman did not give his figures in full, so that others interested in these matters might have had an opportunity of checking the results. The report itself, together with an analysis of battery waste, will be found in our "Notes" columns. With regard to the bye-products of primary batteries we think that too much importance is attached to such refuse. Assuming that valuable material can be obtained from the waste of these cells, what is the expense of extracting it? Could not the same substances be obtained at a cheaper rate by other methods? Is there at the moment any pressing demand for these bye-products? If not, where is their market? If there is a demand they will become cheap in a short time, and then they cannot be claimed by enthusiastic inventors as being sufficiently valuable to pay for the cost of working the battery. Mr. Ross, however, maintains that the zinc which is consumed is recovered in solid form and in augmented quantity, as oxychloride of zinc, which forms the principal ingredient of a new insulating material resembling India-rubber.

Professor Silvanus Thompson, in his admirable work, "Elementary Lessons on Electricity and Magnetism," gives the following particulars, which it will be found useful to remember. "The cost of working electromotors by batteries is great. A pound of zinc contains only about one-sixth as much potential energy as a pound of coal, and it cost twenty times as much—the relative cost for equal amounts of energy is therefore about 120 : 1. But an electro-magnetic engine will turn 85 per cent. of the electric energy into work, while even good steam engines only turn about 10 to 20 per cent. of the energy of their fuel into work. But reckoning electro-magnetic engines as being five times as "efficient" as steam engines of equal power, the necessary zinc is still 24 times as dear as the equivalent amount of coal. This calculation does not take into account the cost of acids of the batteries."

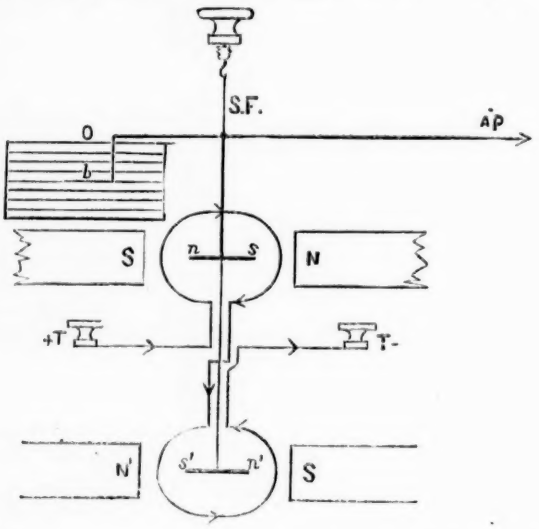
Mr. Ormiston's report states that sulphuric acid, which forms an expensive item in making up a battery, is *not* used, but that which one wishes to learn is what are the liquids actually employed. A guess might perhaps be made which would not be far away from the truth, but it appears to us that the inventors of recent primary batteries do not place much faith in the details of their published inventions, but rather upon a *secret* depolarising fluid or powder, which we always hear of when seeking information as to the constituents of these elements.

THE MEASUREMENT OF ELECTRIC CURRENTS.

THE fourth ordinary meeting of the Philosophical Society of Glasgow was held last week—Dr. Henry Muirhead, president, in the chair. Sir William Thomson made a communication "On the Measurement of Electric Currents and Potentials." The technical subject of the communication was, he said, one of great practical importance to electricians at the present day. It had been recognised as being of importance to scientific investigators of electricity from the earliest discovery of the properties of the matter concerned, but, as they all knew, electricity had of late years taken developments in various directions which brought it quite away from the realm of the mere experimenter and investigator. The question of measuring electrical currents and potentials in definite units became a practical subject in connection with telegraphy, and it was a remarkable fact, and an interesting thing, and one which those engaged in the practical application of electricity might take pleasure in contemplating, that the practical work had reacted on the laboratories. Before 1858 or so—before 1865, he might say—there was scarcely such a thing as definite measurement in electrical currents and potentials in scientific laboratories. The paramount need for measurements in some definite units brought out by the growth of telegraphy, and chiefly submarine telegraphy, from the years 1857-8, the dates of the first Atlantic cable, led practical electricians and others engaged in scientific investigation towards, and ultimately to, a system of practical measurements, some of the fruits of which they now had, in respect to the still more modern developments of electricity in connection with lighting. These practical applications had come so rapidly that they had outrun the capacity of scientific measurers to give convenient and accurate measuring instruments. After referring to the instruments shown at the Vienna Exhibition, he expressed the hope that a great many would apply their minds to the subject of measuring electric currents, and that before another year had passed they would have some small handy instrument which would give results with unerring accuracy up to

a certain percentage, say within 2 per cent. In all the instruments hitherto applied there was generally a want of reliability. He had laboured very much to obtain some improvements in the large field of electric measurements. Sir William then exhibited and explained two instruments of his own invention, one being a graded current meter for measuring electricity, and the other a graded potential meter for measuring the intensity of electromotive force. These instruments are recent improvements upon his well-known ampère and volt meters. In both these improved instruments he employs an astatic combination of needles.

The general outline of his improved voltmeter may be gathered from the annexed diagram, where N — S and N^1, S^1, are strong magnets fixed in the framing of the instrument, n—s and n^1 — s^1, the pair of astatic needles suspended from a hook by means of a silk fibre, S, F, while A,P, is the very light aluminium pointer with a tailpiece or balance, b, moving in paraffin oil so as to check oscillations or act as a damper, without lessening the sensitiveness of the instrument. Beneath the above details there are incased a series of German silver



coils, and by means of a switch there are introduced into the circuit, T_+, T_-, at pleasure with the view of rendering the instrument capable of registering E.M.Fs. from ·01 to 1,000 volts as well as of graduating it. The graduating is done, as a rule, by means of a standard Daniell cell, consisting of a shallow square dish of clean copper of about 6 in. × 6 in. × 1½ in. deep, into which is fixed, about ¾ inch from the bottom, a flat zinc plate, having ½-in. clear between it and the copper. Sulphate of zinc of a specific gravity of 1·02 is first poured into the copper dish, then a definite quantity of a saturated solution of sulphate of copper is very gently poured, just sufficient to cause the sulphate of zinc to rise (it being lighter) and cover the zinc plate. This element is short circuited for a few minutes, so as to deposit a thin clean copper coat on the copper dish and then applied to the instrument to be graduated. Sir William finds that such a cell, if carefully made, has a fixed E.M.F. of 1·072 volts, he cannot swear by the two, for sometimes it may be 1·073 or even 1·075, but the difference is very slight if always made and used in the same way. He arranged such a cell at the meeting and showed how it was applied to this new voltmeter so as to graduate it. With the resistance of the coils of his instrument only in circuit with the standard cell (*i.e.*, 1·072 volts E.M.F.) he got 22 divisions deflection. Now, if the instrument was to be used with an E.M.F. of 107 volts he would only have to introduce by his switch and German silver resistance coils 100 times the resistance into the circuit which he had at present with 1·07 volts or 700 Ohms, in order to get the same deflection of 22 divisions, under a pressure of 107 volts. He thus demonstrated the wide range easy calibration of his instrument.

He then explained his current meter, which is similar in principle, but with very large copper bands for conductors and coils. Finally, he explained his "Mho" meter. This new term, which was only the Ohm spelt backwards, or what the phonograph produced on calling the word Ohm into it. It is the reciprocal of the Ohm, and his instrument had for its object the easy measurement of conductivities, or the reciprocal of resistances. He said he had often asked at the late Vienna Exhibition, what was the resistance of such and such an armature, the reply invariably being that it was "so very small or inappreciable." Now, it was a great mistake to suppose that such a resistance, although small, did not have an important bearing in regard to the efficiency of such machines as dynamos. It was difficult to get practical electricians to measure to 0·001 of an Ohm, but if they had an instrument to measure at once the reciprocal of this resistance, or $\frac{1}{1000} = 1000$ Mhos, then they would appreciate the result at once. Such an instrument he had devised, and it was capable of measuring accurately in the way described, the conductivity of a few feet of copper wire. It was a modification of his original paddle-wheel galvanometer, with two fixed coils and a moveable one between them. By the deflection of the central coil placed in circuit with the wire to be measured and a battery, and multiplying the tangent of the angle of deflection into the constant of the instrument, the "Mhos," or reciprocal of the resistance was obtained at once, to a degree of accuracy, which he had never before been able to reach with ordinary instruments.

Great interest was shown by the audience in Sir William Thomson's address, and in the instruments. Mr. Dunlop, Principal Jamieson, and Prof. Blyth, as well as Mr. Grant, of the Edison and Swan United Company, asked Sir William Thomson several questions so as to elicit more fully the details of his instruments and his experiences on certain points, such as the permanency and reliability of spiral springs, and the retentiveness of steel magnets.

A hearty vote of thanks was accorded to him on the motion of the Chairman.

THE NEW PATENT ACT.

THE act to amend and consolidate the law relating to Patents for Inventions, Registration of Designs and Trade Marks, which was passed during the last session of parliament, has been in force for about a fortnight only, and already we are beginning to hear wide-spread complaints of the probable results of its working, and demands for its alteration and improvement in the coming session of Parliament. Despite the proverbial character of the British public for grumbling and discontent at any radical change which does not realize the ideal of absolute perfection, we are bound to admit that the expressions of dissatisfaction and the claims for amendment which have reached our ears, are not altogether groundless and unwarranted by the circumstances of the case. Indeed, in our article on the subject shortly after the act was passed (see ELECTRICAL REVIEW for October 13th and 30th, 1883), we pointed out many of its shortcomings, and more mature consideration certainly does not lead us to a more hopeful view of the prospects of an inventor under it, notwithstanding the specious advantages held out to him of a reduction of fees for the first four years of the patent.

While however we join in the demand for a prompt revision of the act, we do not wholly concur in the reasons upon which the demand is based.

For example, exception has been taken, and justly so, to the examination sections in the act, but it is argued that since the official investigation required by the act is objectionable and of little if any utility, no examination should be made of the contents of applications for patents. Now it certainly seems to us that

this is a most illogical conclusion to draw from the given premises. We agree that the act goes either too far or not far enough, and that of two alternatives, viz: to have the examination provided for by the act or to have no official examination at all, we should prefer the latter, but at the same time we cannot refrain from expressing our conviction, that the institution of a thorough examination at the hands of qualified men as to the novelty and patent ability generally of each alleged invention forming the subject of a patent-application is not only not opposed to the true interests of the *bona fide* inventor, but is the best thing that could possibly take place both for inventors themselves and for users of inventions—that is to say, the public generally.

It is true that a large proportion of the patents which are taken out are of no utility, and it may therefore seem to be a waste of public money to carefully examine such a large number of specifications, simply to ascertain that they contain nothing of any value; but on the other hand we contend that it is a much greater evil to pocket the inventors' fees and without troubling to make any examination, to grant patents to all comers, than to weed out the bad from the good and issue patents only when there is reasonable ground to believe they will be supported by a judicial tribunal. Surely the latter system is most calculated, as we have said, to promote the interests both of inventors and of the general public—of inventors as giving them an equivalent for their money—of the public generally, as protecting them from the arts and wiles of unprincipled men who will trade upon the mere semblance of a patent and make use of it to impose on the credulity and submission of the British public.

It is unnecessary to add that care should be taken to secure such a high class of men as examiners, that no risk will be incurred of their abusing the confidence reposed in them. This of course means the expenditure of a good deal of money, but when we are reminded of the large accumulated surplus in hand derived from patent fees, the mere pounds, shillings and pence aspect of the matter should not deter the Board of Trade from doing that which is essentially necessary for the best interests of all parties, as after a short time the expenses will be met by the increasing revenue of each current year arising from the increase in the number of applications.

Another point which has been mooted, is the desirability of abolishing provisional specifications and provisional protection, or, at any rate, of inventors avoiding this alternative method of protecting their inventions and instead thereof filing their complete specifications in the first instance. In our former article on the new patent law, we expressed the opinion that a provisional specification was now of little use and that inventors might as well file their complete specifications with their applications. We still adhere to this opinion, except in cases where an inventor is unable to apply for his foreign patents at the same time as his British patent, as since the complete specification is almost immediately thrown open to inspection, this publicity will in such cases be an absolute bar to his obtaining a patent in certain foreign states, and will expose him to great risk in others, whereas the provisional specification being kept secret the patentee is enabled to defer his applications in foreign states without prejudice to his rights to obtain patents there.

Whether, however, the system of provisional protection be retained or not it is quite clear that the practice of publishing the complete specification before the allowance of the patent, is open to the gravest objection. Upon this point there can be scarcely two opinions. The trouble and expense from vexatious opposition which will be due to this cause alone, cannot be estimated, but it is pretty clear that it will not be possible for any applicant of limited means to hold his ground against his opposer, should the latter happen to be a capitalist. We trust therefore that this portion of the act will be speedily repealed, as it will be far better for the patentee, for the Patent Office to institute a thorough examination privately of each application than to prematurely throw the specification open to the public, and thus by inviting opposition, impose on the patentee the obligation of defending the novelty of his invention against all the world at the very inception of his patent.

T. J. HANDFORD.

VOICE'S MOTOR-INDUCTION MACHINE.

[A COMMUNICATION.]

FARADAY, in his "Experimental Researches in Electricity," shows a very interesting experiment in demonstrating a particular mode of electro-magnetic induction. The accompanying drawing, fig. 1., is a fac-simile of his explanatory diagram.

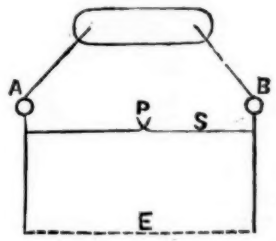


FIG. 1.

A and B are battery terminals; E is an electro-magnet placed in electrical communication with A and B; S is a shunt conductor of higher resistance than the main circuit.

Assuming the main circuit to be closed, the electro-magnet, E, is powerfully magnetised. If contact is now broken at A or B, the magnet is demagnetised and a powerful direct current is set up in its convolutions which has no alternative but to traverse the shunt wire, S. At the point, P, all the usual electrical effects may be obtained, as the spark, decomposition of water, &c.

It will be seen that when contact is made with the battery, no electrical effect is obtained; and in this it differs from the ordinary induction coil with the

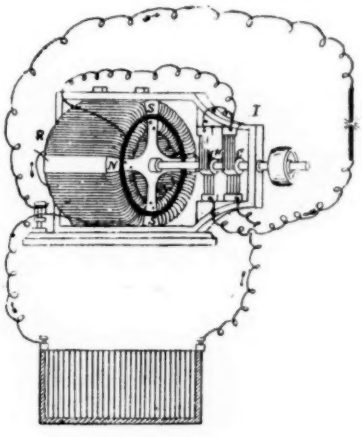


FIG. 2.

primary and secondary circuits. The force set up, however, on making contact, is magnetic, inasmuch as the magnet, E, is capable of doing mechanical work by moving masses of iron by attraction towards its poles. Each induced current obtainable at P is more powerful when contact is made and broken slowly. This is because the inverse current set up in the magnet on making contact, has time to expend itself before contact is again broken. The inverse current, being opposed

to the battery current, weakens the latter when the magnet is rapidly demagnetised.

The apparatus which is the subject of the present article is constructed on the above principle. The most convenient form of machine is shown at fig. 2. The pole pieces of the outer ring or field-magnets, R, are alternately arranged, and are fixed to a core of soft iron wires to facilitate demagnetisation. The armature is similarly built up. The commutators, C and C^1, are shown on a larger scale at fig 3. The commutator, C^1, forms the circuit to and from the armature, and while it enables the induced currents to be taken off from the armature, it also causes these currents to traverse the consumption circuit in the same direction as the induced currents derivable from the field-magnets.

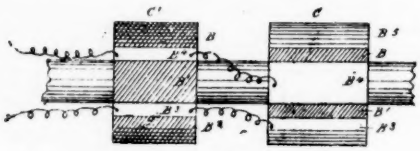


FIG. 3.

In all motors that depend on the cessation or reversibility of current to obtain a revolution of the armatnre—as in the Griscom motor—the field-magnets and armatures are periodically demagnetised; the time of such demagnetisation being governed by the thickness of the insulating strip of the commutator divisions.

It is well known, and can be proved by Faraday's experiment above quoted, that by demagnetising a magnet, a powerful *direct* current is set up in its coils. This is the current which causes the spark in existing electro-motors, but which is now utilised in lighting Swan lamps.

As the field-magnets in the machine (fig. 2) are periodically demagnetised without reversal of polarity, the induced currents derivable therefrom are, of course, all in the same direction. Those from the armature, however, are alternating, hence the necessity for commutation at C^1 to render these induced currents continuous.

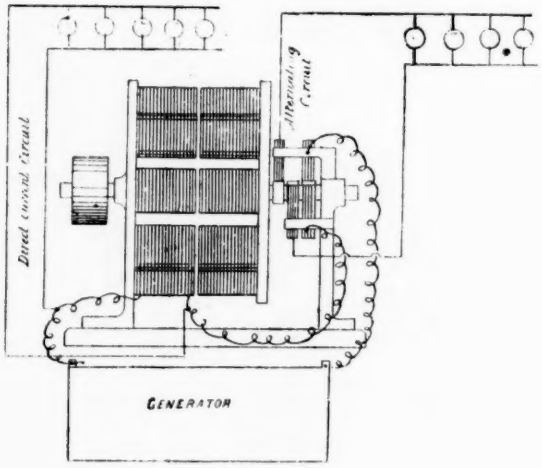


FIG. 4.

Fig. 4 shows a machine in which the induced currents derivable from the field-magnets and armature respectively, are taken off in separate consumption circuits; the armature circuit being alternating while the field-magnet consumption circuit is continuous. In this case the commutator, C^1, is dispensed with, the induced currents being taken off from the armature by collectors pressing on insulated metallic bands fixed to the shaft.

Attention has already been drawn to the fact that, when contact is made with a battery enclosing a magnet in its circuit, as in Faraday's experiment, an inverse current is set up in the magnet which is opposed to, and consequently weakens, the battery current. The effect of this inverse current is, however, partially, if not quite neutralised, when the magnet is in the form of an electro-motor.

Let fig. 5 represent a segment of the machine, fig. 2, A being the field-magnet and B the armature. Imagine the current to suddenly develop polarity, as shown. Obviously the N and S of of the field-magnet would tend to induce opposite polarity in the armature, and the current arising in the latter by reason of such induction, would be in the same direction, snd would assist the current which developed the polarity indicated. The armature would likewise react on the field-magnets so that their mutual induction would tend to counteract the inverse currents set up in the magnets themselves by the battery current. In other words, the electrical resistance of two electro-magnets *when contact is made with a battery* is, for an instant, much less when the magnets are adjacent to each other with like poles joining, than when they are some distance apart.

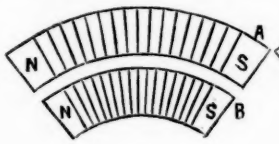


FIG. 5.

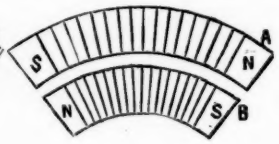


FIG. 6.

The position of the magnets at fig. 5 corresponds with the motor (fig. 2) when the commutator causes the armature poles to be of the same sign as the field-magnets, so as to repel them until they attain the position as shown at fig. 6.

The position of the magnets as seen at fig. 6, is that at which the field-magnets and armature are demagnetised. The induced current produced by reason of such demagnetisation is more powerful on account of the two magnets being in close proximity to each other. The induction of N, S of the field-magnet tends to increase the magnetism of the armature, and the latter has the same effect on the former; this being the place of most intense magnetic action and forming, practically, a closed magnetic ring. It follows that when such an arrangement of magnets is demagnetised, a *direct* induced current is set up which, probably, is the most powerful induced current that it is possible to obtain. This is the current that is utilised in the consumption circuits of the above machines.

The mutual action, or rather reaction, of the field-magnets and armature on each other in different positions may be considered by ignoring the polarity of the magnets altogether, and perhaps better understood by studying the action of currents on currents.

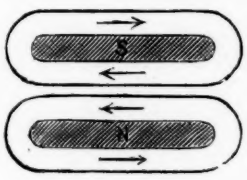


FIG. 7.

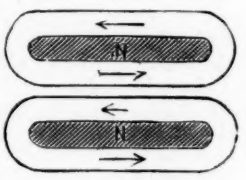


FIG. 8.

Let N and N^1 (fig. 7) represent sections of the field-magnets and armature respectively when they are in the position as shown at fig. 5. Imagine a current to suddenly exist in the direction indicated by arrows. It will be seen that the current on the under side of N is in an inverse direction to that on the top of N^1, and it is well known that when a current is caused to exist, it induces an inverse current in a neighbouring conductor, so that at fig. 7 the two magnets mutually assist each other *when contact is made* by the commutator.

Now let fig. 8 represent the magnets in the position

shown at fig. 6. The direction of current will be as indicated by the arrows.

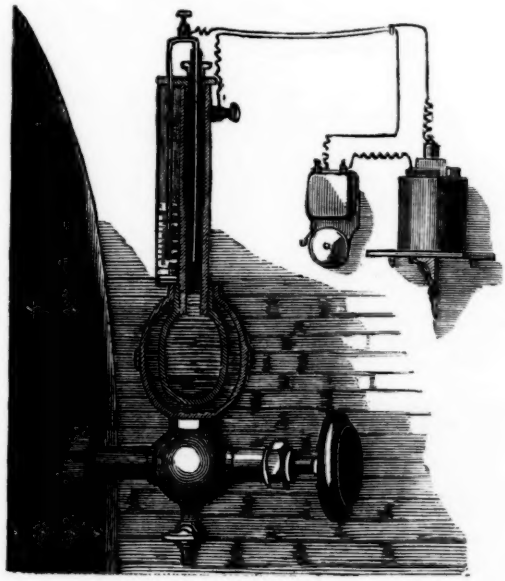
Evidently the cessation of current on the under side of N will induce a current in the *same* direction at the top of S, and *vice versâ*. This is what actually occurs in the above machines (fig. 2) each time the polarity of the armature is reversed, to enable it to continue its revolutions.

The machines, fig. 2 and fig. 4, may remain at rest and be utilised as induction machines or transformers of electrical energy, and when supplied by a battery with contact breakers or movable commutators, they develop induced currents which are all in the same direction, giving practically a continuous current. When used as an induction coil "pure and simple," the apparatus is constructed in any suitable form having one main circuit, the consumption circuit being joined to the flow and return wire of the main circuit outside of the induction apparatus. They may be also supplied by an alternating dynamo machine, the inverse current set up in the battery of magnets supplying the lamps in derived circuits. The writer has proved by comparison that there is a distinct advantage in the latter method.

E. L. VOICE.

AN ELECTRIC ALARM FOR STEAM BOILERS, &c.

THE object of this invention is to provide an electric alarm apparatus more especially intended for use as a low water indicator for steam boilers. The device, which we find in the *Scientific American*, consists of a mercury bulb enclosed in a sectional globe which forms a chamber around the mercury bulb, as shown in the engraving. which represents the contrivance in vertical section, and attached to the side of a boiler. The chamber communicates with the interior of the

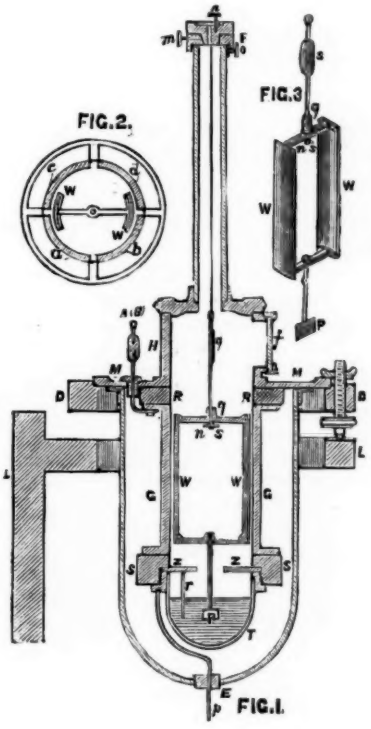


boiler through the valve stem, to which the globe is attached. In the plate which closes the upper end of the tube of the thermometer-like device, is fitted a thumb nut through which passes the insulated arm of a bent rod. The insulating material on the arm is threaded to match the screw threads of the nut, so that by turning the nut the bent rod may be raised or lowered to suit the temperature at which it is desired to have the alarm given.

The other arm of the rod is of the same length as the first, and reaches down in front of a graduated plate attached to the thermometer tube, thus serving as an indicator for setting the rod with reference to the degree marks on the plate. In the upper right hand corner of the engraving is shown the battery and the electric alarm, which are connected by wires to the bent rod and mercury tube. When the water in the boiler stands above the low water line, the water entering the chamber through the stem will prevent the entrance of steam, and the mercury in the bulb will have the same temperature as the water, causing it to stand in the tube somewhat below the lower end of the arm. When the water in the boiler falls below the low water line, steam will enter the chamber, and, being of a higher temperature than the water, will cause the mercury to rise in the tube until it comes in contact with the end of the arm, when the electric circuit is completed and the alarm sounded. In the spindle is fitted a screw plug for cutting off communication between the chamber and boiler in case it should be desired to unscrew the apparatus. The upper end of the mercury tube is enlarged above the end of the rod in order to prevent all danger of overflow of the mercury in case of excessive heat.

EDELMANN'S ELECTROMETER.

AMONGST the many forms of electrometer that derive their origin from the quadrant electrometer of Sir William Thomson, is that of Edelmann, which is very extensively used in the physical laboratories of the Continent. Dr. Edelmann, whose name it bears, is not only proprietor of workshops in Munich, which are rapidly winning renown for the excellence of the



instruments which they turn out, but also holds the post of *privat-docent* in the Polytechnicum of Munich.

In the parent instrument of Sir W. Thomson, and in most of the modifications of that instrument which go by the names of Branly, Kirchoff, Mascart, &c., the quadrants are literally four quadrants cut from one plane circle; and in most of these instruments the *needle* is of the flat dumb-bell or lemniscate form which Sir W. Thomson himself gave to it. Dr. Edelmann has, however, taken a departure in quite another line,

his instrument being very appropriately named the "cylinder-quadrant" electrometer. The three accompanying figures and description, taken from *Nature*, show the essential parts of the instrument. The quadrants, marked G in Fig. 1, and *a*, *b*, *c*, *d*, in Fig. 2, are formed by taking a metal tube, furnished with flanges above and below, and slitting it into four parts by four equidistant cuts parallel to the axis of the tube; the four pieces being then set in their proper places by being screwed to two rings, R and S, of ebonite. This arrangement has some advantages over those of the ordinary quadrant electrometers. In these, when the quadrants consist of four pieces of flat brass, borne each on an insulating pillar, it is difficult to set them so that they shall be all exactly in one plane; and when, as in some of the more delicate instruments, the quadrants are made of a hollow box slit into four parts, there is found the further difficulty of arranging the quadrants so that the needle can be taken out and replaced. These difficulties are, to a large extent, obviated in Dr. Edelmann's form of instrument; for the inner surface of the cylinder, which constitutes the four quadrants, can be turned perfectly true after the quadrants have been screwed to the ebonite rings; and there is no difficulty at all in lowering the needle into the cylindrical cavity within the quadrants, or in lifting it out. The needle itself is of the form shown in Figs. 2 and 3, and consists of two portions of metal (W W) cut from a cylinder, united above and below, and hung by a single fibre of small torsion from an adjustable head, F, above. A mirror, *s*, is attached above the needle, and a platinum vane, P, below it dips into a vessel, T, containing sulphuric acid. To give directive force to the "needle" a small magnetic needle, *n s*, is attached to it. This device was indeed used in some of Sir W. Thomson's early instruments, though subsequently abandoned in favour of the bifilar suspension usually adopted. It is of course understood that the opposite pairs of quadrants are, as usual, connected together. Electrodes, A, B, pass through the metal plate, M, which covers the instrument, and are connected with the quadrants as shown in Fig. 1. An outer jar of glass surrounds the instrument and is fixed to the under side of the plate, M, by a bayonet point. The plate, M, itself is very substantial, and is provided with three levelling screws which rest in V-grooves in a strong ring-shaped support of cast zinc, L, L, which is screwed to the laboratory wall like a bracket.

It will be seen that Dr. Edelmann has discarded the Leyden jar, replenisher, and gauge, which play so important a part in Sir W. Thomson's electrometers. Instead of these a Zamboni pile, or a battery of 200 small well insulated voltaic elements, is used. These are made of test-tubes filled with common water, and having small zinc-copper pairs placed from cell to cell. It is difficult to believe that either of these dispositions is an improvement on the replenisher-jar-gauge arrangement, though either may be somewhat cheaper. Nor is it likely that the presence of the ebonite rings, R and S, will add, in the long run, to the satisfactory working of the instrument; for, as is well known, this substance when exposed to light decomposes at the surface, and becomes covered with a conducting-film of acid. The insulation of the quadrants ought not to be risked by such a doubtful device. It ought to be mentioned that a cylindrical arrangement of quadrants had been previously employed by Silow in an instrument for investigating the dielectric capacity of liquids; but to Dr. Edelmann is due the credit of having applied this arrangement for the construction of these electrometers, which, in consequence of their many good points, are becoming so popular for laboratory work both in Germany and elsewhere.

Telegraphy in Japan.—According to a statement in the *Times*, given on the authority of the Japanese Embassy in London, there are 4,733 miles of telegraph (12,470 miles of wire) in Japan, the number of telegrams despatched in 1882 being 2,784,287.

ON THE FUNDAMENTAL NOTIONS OF ELECTROSTATICS. (QUANTITY, POTENTIAL, CAPACITY, &c.)

By E. MACH.

A discourse delivered at the International Electrical Exhibition in Vienna, September 4th, 1883.

(*Continued from page* 29.)

We fit up the jar, F, with spark-balls, for spontaneous discharge, of the same size and distance as those of L, (fig 5). If we then find that, *e.g.*, five discharges of the measuring jar, L, take place before a spontaneous discharge of the jar, F, this means that for one and the same distance of the balls, at equal striking distance, F can contain five times as much electricity as L.

We will now substitute for the measuring jar, L, with which, so to speak, we have measured electricity into F, a Franklin's table, consisting of two smooth parallel metal plates, separated merely by air. (Fig 6.) If 30 discharges of the table are sufficient to fill the jar, 10 only are required if the space between the two metal plates is filled up with a cake of sulphur. The capacity of a Franklin's table with sulphur is, therefore, three times greater than that of an air-condenser of the same form and size, or, as the fact is commonly expressed, the specific inductive power of sulphur — taking that of air = 1 — is 3. We have thus come upon a very

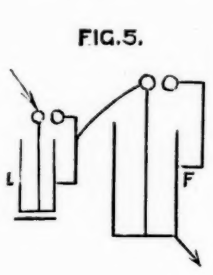


FIG. 5.

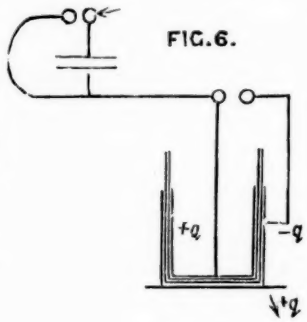


FIG. 6.

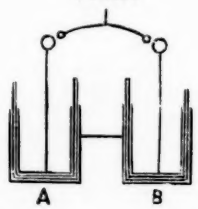


FIG. 7.

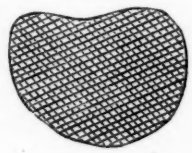


FIG. 8.

simple fact, which gives us the meaning of the figure known as the dielectric constant, or the specific inductive power, the knowledge of which is so important for the theory of submarine cables.

Let us consider a jar, A, charged with a certain quantity of electricity. We may discharge the jar directly. Or we may discharge the jar A (fig. 7), partially into a jar, B, by connecting the two outer coatings with each other. A part of the quantity of electricity passes then, with the formation of sparks, into the jar, B, and we find both jars charged.

That the conception of an unalterable quantity of electricity may be regarded as the expression of a pure fact, appears as follows. We suppose any given electric conductor (fig. 8), which is insulated. We cut it into a great number of small pieces and bring it, by means of insulated forceps, to the distance of 1 centimetre from an electrified body, which exerts the unit of force upon an equal and similar body at the same distance. We count up the forces which the latter body exerts upon the single pieces of the conductor. The sum is none other than the quantity of electricity of the entire conductor. It remains the same, whether we alter the form and size of the conductor, whether we approach it to or remove it from another conductor, as long as we

leave it insulated; or, in other words, as long as we do not discharge it.

From another point of view a firm basis may be found for the notion of electric quantity. If a current, or according to our view, a certain quantity of electricity per second is passed through a column of acidulated water, hydrogen is eliminated in the direction of the positive current, and oxygen in the opposite direction. The column of water may be conceived as a column of hydrogen and oxygen, which force their way through each other. We may say the electrical current is a chemical current, and *vice-versâ*. Although this view is not easily held fast in the region of statical electricity, with non-decomposable conductors its further development is not without prospects.

The notion of electric quantity is, therefore, by no means so airy as it might seem. It is able to lead us with safety through the multiplicity of phenomena, and it is brought home to us by facts in an almost tangible manner. We can collect the electric force in a body, measure it from one body into another, convey it from one body to another, precisely as we do with liquids.

For, judging from mechanical processes, experience has shown us a standard, known by the name of work. A machine becomes in motion only when the forces applied to it perform *work*.

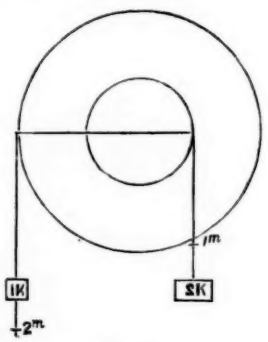


FIG. 9.

Suppose a wheel and axle (fig. 9), where the wheel has the diameter 2 metres and the axle 1 metre, a weight of 2 kilos being applied to the latter and of 1 kilo to the former. If we turn the wheel we see the kilo weight descend 2 metres, whilst the two kilo weight rises 1 metre. The product on both sides is equal, for 1 kilo × 2 metres = 2 kilo × 1 metre. So long as the product on both sides is equal the wheel does not move of itself. But if the weights or the radii are so selected that the product-kilo × metre preponderates on one side, the weight on that side will descend. The product is therefore characteristic for the mechanical process, and has received the characteristic name of work.

In all mechanical processes, and as all physical processes present a mechanical phase, in all physical processes work plays a determining part. The electric powers also produce only such changes in the case where work is performed. When, in the electric phenomena, forces come into play, they extend, whatever may be their nature, into the sphere of mechanics, and have to submit to the laws which hold good in this sphere. As the standard of our work we therefore consider the product of the power, and the distance through which it acts. In the "centimetre-gramme-second" system the unit of work is the action of a power which gives a gramme in a second an increase of velocity of 1 centimetre through the distance of 1 centimetre, or approximately speaking the effect of a milligramme weight over a distance of 1 centimetre.

From a body charged positively, electricity following the force of repulsion and performing work, will flow down to the earth. To a body charged negatively on the other hand the earth, under similar circumstances, gives off positive electricity. The electric work which is possible by the reciprocal action of a body with the earth characterises the electric condition of the former. We will call the work which we bestow upon the unit of the quantity of positive electricity when we transfer it from the earth to any body, the potential of the body, K.

We ascribe to the body, K, in the centimetre-gramme-second system, the potential + 1 when we must expend the unit of work in order to convey the positive electrostatic unit of electric quantity to it from the earth. We assign to it the potential — 1 if during the same process we gain a unit of work, and the potential 0 if no work is performed.

To the different parts of one and the same conductor in a state of electric equilibrium, there corresponds the same potential, since otherwise the electricity would move in the conductor performing work, and no equilibrium would exist. Various conductors of equal potential, brought into conductive connection occasion no exchange of electricity, just as bodies of equal temperature in contact undergo no exchange of heat, and as between reservoirs filled to the same level with water and under equal pressure there takes place no interchange of liquid.

Only between conductors of different potential does there occur an interchange of electricity, and for conductors of given form and position a given difference of potential is necessary in order that a spark may strike through the insulating air between them.

Any two connected conductors take at once the same potential, and a means is thus afforded of determining the potential of a conductor by the aid of another suitable body—a so called electrometer just as the temperature of a body is determined by means of the thermometer. The potential values of bodies thus ascertained facilitate—as appears from the foregoing—a judgment on their electric behaviour.

Suppose a conductor positively charged. Let us double all the electric forces which it exerts upon a point charged with the unit; *i.e.*, let us double the quantity at each part and consequently the total charge. The equilibrium evidently continues. If we now convey to the conductor a positive electrostatic unit, we have everywhere to overcome, as before, the double repulsive forces; we have to expend double the work; the potential has increased with the charge of the conductor; charge and potential are respectively proportional. If we call the total quantity of electricity in a conductor, Q, and its potential, V, then $Q = C V$, C signifying a constant, the meaning of which appears if we consider that $C = \frac{Q}{V}$. If we divide the number of the units of quantity of a conductor by the number of its potential units, we find what number falls upon the unit of the potential. We call the number C, the capacity of the conductor, and have thus, in place of a merely relative, an absolute determination of capacity.

(*To be continued.*)

NOTES.

Electric Lighting.—Mr. Augustus Harris has introduced the electric light into the transformation scene at the Drury Lane Pantomime. The lights are fixed on to the fairies' heads, and at a given signal are turned on simultaneously with very great effect. A very small secondary battery, upon a slightly new principle, is used, weighing about 1½lbs., and the lamps, batteries, and fittings have been designed and manufactured by Messrs. Woodhouse & Rawson.

In our last issue we notified the partial lighting of Grangemouth by electricity. The work has now been completed, and on Friday of last week the turning on of the electric light was performed by Provost Macpherson in presence of a number of the commissioners of the burgh and officials of the Caledonian Railway Company. In the twinkling of an eye the Old and New Docks were illuminated, much to the

surprise and delight of a large concourse of people. On adjourning to the hydraulic-room, Provost Macpherson congratulated, in the name of the commissioners present, the Caledonian Railway Company on having introduced the electric light, and remarked that it was the first seaport in Scotland that was thus lighted. He further remarked that the shipping community was under a deep debt of gratitude to the railway company for the admirable facilities granted, which he was certain would enable both steamers and sailing vessels to work during the night as well as by day. Mr. Clapperton, a representative of the Caledonian Railway Company, returned thanks, remarking that during the past year the tonnage of the port had reached upwards of one million tons, which was 170,000 in excess of any former year.

In speaking of the Dundee Fine Art Exhibition, which closed last week, the *Dundee Advertiser* says: "Great credit is due to the Northern Electric Lighting Company for the very efficient manner in which the galleries have been lit during the present season. Members of the Royal Academy of London and other visitors from the metropolis have been warm in their praise, all declaring that nowhere in any of the London Exhibitions has the electric light been so successfully managed as in Dundee. Much credit is due to all the employes of the Northern Lighting Company, and especially to the able and enthusiastic manager Mr. Loring, for the unwearied personal attention he has been giving nightly to secure this great success."

It is contemplated to light the premises of the London and Provincial Steam Laundry Company, Battersea Park Road, and tenders have been invited for the purpose.

Messrs. Holmes & Vaudrey inform us of the following Electric Light Installations which they have carried out during 1883, for the Liverpool Electric Supply Company, Limited. Eberle's Army and Navy Hotel, London; Conservative Club, Liverpool; Junior Conservative Club, Liverpool; Eberle's Restaurant, Liverpool; Public Free Library book-rooms, Liverpool; Brown Museum, Liverpool, at the British Medical Society's soiree. Messrs. Woodward, Grosvenor & Co.'s Carpet Manufactory at Kidderminster; Grand Hotel, Liverpool; and Messrs. Willey & Co.'s Showrooms, Liverpool.

A largely attended meeting of the Insurance and Actuarial Society was held in the Accountant's Hall, on Wednesday week last, when Mr. John P. Tawse, Lancashire Insurance Company, the secretary, read a paper on "Electric Lighting."

The Jablochkoff Electric Light and Power Co., has contracted to light the floral hall, Covent Garden, for the forthcoming Stanley Bicycle Club Exhibition. The installation will consist of seven Jablochkoff arc lamps of 1,200-candle power each, and seven of 800-candle power each, together with fifty incandescent lamps of 20-candle power each, the whole to be driven from the Belvedere Road lighting station.

Tenders are required for lighting by electricity the new dock works at Tilbury, during construction. For particulars apply to Messrs. Kirk & Randall, contractors, Woolwich.

On the evening of Wednesday, the 16th inst., Dr. N. S. Keith was to deliver a lecture on "Electric Lamps and Regulators," before the New York Electrical Society.

The Electric Light Company of Kansas City, U.S.A., has now 140 arc lights in operation, 35 having been added since November last.

The Howard Oil Mills, of Houston, Texas, have been illuminated by means of 100 Maxim incandescence electric lamps.

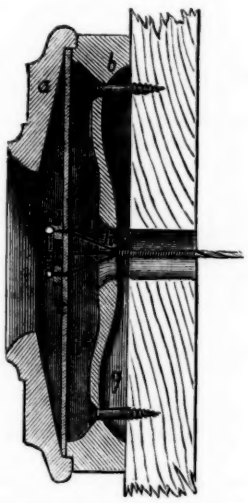
The United Telephone Company *v.* **Dale.**—Mr. Cozens-Hardy and Mr. Moulton appeared before Mr. Justice Pearson, on Tuesday, in support of a motion to commit Henry James Dale and Edward Jonathan Dale to prison for contempt of court in manufacturing, selling, and using "carbon transmitters" manufactured according to the manner described in certain letters patent dated the 30th of July, 1877; and also in manufacturing, selling, and using "telephone transmitters and receivers" manufactured according to the manner described in certain letters patent dated the 9th of December, 1876, in disobedience of the judgment of the court delivered in the action on the 1st of February, 1883. Mr. Higgins, Q.C., and Mr. Farwell appeared for the defendants. Mr. Justice Pearson said this was an action commenced in January, 1883, and on the 23rd of that month the defendants, being so convinced that they could offer no defence to the action, wrote a letter in which they consented unconditionally to an injunction as to one part; and on the 1st of February they consented to a perpetual injunction as to both parts of the motion. This showed that there had been no mistake on the part of the defendants as to what was the subject matter of those parts, or what was the exact infringement now complained of. It now appeared that there had been a very flagrant and disgraceful breach of the injunction. It was admitted that in July, 1883, the defendants had fitted up certain apparatus for Messrs. Farriloe, and when challenged with this conduct in September they wrote to the company saying that that was the only case in which they had violated the terms of the injunction, and that the company could inspect their books at any time. It then appeared that after the injunction was granted they were actually sending this very apparatus to Mr. Tidman for sale, and stating that they sent him no invoice with it because (as Tidman understood) they wished to avoid any entries in their books relating to it. Of course, if they had entered these sales in their books, the books would at once have shown that the injunction had been broken. They were therefore attempting, secretly and in fraud, to obtain an advantage which by the injunction they were restrained from doing. Fortunately, for the sake of justice, their letters remained to convict them; and they convicted them so clearly that it was impossible to offer any defence to the present motion. But then a preliminary objection was taken that the injunction had never been served upon the defendants, and the rule relied upon was that in no case where, as here, there had been sufficient time to draw up, enter, and serve the order, could the court make an order to commit to prison, without actual service of the injunction upon the defendants. This rule, however, his lordship must decline to act upon as meaning that in no case could the court enforce its order by committal, simply on the ground of the order not having been served, when it appeared beyond all doubt that the defendant was aware of the injunction having been granted, and of the intention of the plaintiff to enforce the order. In this case the service of the order was under the circumstances unnecessary. There had been a most discreditable breach of the injunction, and the court would be departing from the duty which it owed to the public if it did not order that these defendants should be committed to prison. It was stated by Henry James Dale that his brother Edward knew nothing about the matters complained of; but Edward Dale had made no affidavits, and it appeared to be inconceivable that he should not have known of them. He could therefore make no distinction between the two brothers, and there must be an order for their committal to prison, and an order that they must pay the costs of this motion.

In the same court on Wednesday, Mr. Higgins, Q.C., applied to his lordship to exempt the defendant, Edward Dale, from committal, and produced an affidavit to the effect that he never had anything to do with the sale of goods, and was not concerned in the preparation and publication of the catalogues. He was not an electrician, being, in fact, a "conjuror" by profession, taking no part in the management of the firm. Mr. Cozens-Hardy said he was not in a position to contradict these assertions, whereupon his lordship said it

was quite plain that the defendant, Edward Dale, was not a partner in the ordinary acceptation of the term, and that the person really managing was the other partner; therefore he would grant the application for his exemption from the committal to prison.

The St. George Telephone Company, Limited.—A petition was presented on Saturday, by Mr. Paterson, a shareholder, for the winding up of this company, and Mr. Justice Chitty made the necessary compulsory order.

Miller's Mechanical Telephone.—The mechanical telephone herewith illustrated, is the invention of Mr. A. G. Miller, of Leyden, New York, and it will transmit and receive speech with great clearness and naturalness of tone. The mouth piece, *a*, has a central aperture for the passage of sound waves to the diaphragm, *c*, whose edges are secured within a rabbet of the mouth piece. The diaphragm is about 7 inches in diameter and is made of spruce wood, which possesses great sonorousness combined with strength sufficient to sustain the tension of the line wire. The mouth piece and diaphragm are held to the wall on a bed piece, *b*, by the tension of the line wire. The bed piece is recessed at both sides, *f*, *g*, and centrally apertured for the passage of threads connecting the line wire to the diaphragm. The front recess, *f*, affords a space between the diaphragm and the centre of the bed piece for free action of the diaphragm, promoting clearness of enunciation when the instrument is used as a receiver, and the rear recess, *g*, secures a small marginal support for the transmitter, thereby avoiding a large contact with the wall and preventing excessive vibration. To avoid indistinct articulation and the ringing sounds common to acoustic telephones, the line wire is connected to the diaphragm by silk cords, which are twisted about the end of the wire to obtain a firm connection therewith, and which diverge into three or more strands that are secured to a metal ring, *c*, between which and the diaphragm a rubber or leather ring, *d*, is interposed. The line wire is made of strands twisted together and coated with varnish to bind them and prevent them rubbing upon one another. This construction of the line wire makes it strong and protects it from the weather, and combined with the silk cord connections, aids largely in clear transmission over line wires of considerable length.—*Sc. American.*



Cheap Telegrams.—Owing to the influx of work that is expected to accrue from the adoption of the cheaper rate of telegraphing next October, the postal telegraph authorities in London have issued instructions to their manipulative staff to conclude the season of their annual leave-taking this year by the end of September, so that all may be in their respective places, ready for any contingency that may arise upon such occasion. The first half of the new floor that is being added to the Central Telegraph Office is fast approaching completion, and is expected to be ready for occupation shortly.

Honours to a Telegraph Engineer.—Sir Francis John Bolton, C.E., the newly-created knight, is the son of the late Dr. Thomas Wilson Bolton, surgeon, of London; he was born in 1831, and educated at Morden Hall. He received his first commission in the army in 1857; became lieutenant and adjutant, 1858; was appointed to the garrison staff, 1859; served in the Gold Coast Artillery with the expedition against the Crobboes in 1858, including the action of the Crobboe Heights on the 18th September, and in the expedition against the Dounquah rebels in 1859, which resulted in the capture of all the rebel chiefs. For his services on the West Coast of Africa he received special thanks, and was promoted to a captaincy in the 12th Regiment in 1861; served on the staff as D.A.Q.M.G., and was attached to the Royal Engineers, 1866-69; promoted major unattached in 1868, for special military scientific services; lieut.-colonel, 1877, and retired colonel, 1881. He is the inventor of the system of telegraphy and visual signalling, which was adopted into Her Majesty's services in 1863. This system now forms part of the army organisation, and has been successfully applied on active service in the recent Abyssinian, Indian, African, and Egyptian wars, and is also adopted generally in India and the colonies. He received the honour of knighthood for his special services to the army. He is a civil engineer, and was appointed the water examiner under the Metropolis Water Act, 1871. He is the founder and hon. secretary of the Society of Telegraph Engineers and Electricians; and is a member of the United Service, Junior United Service, and Devonshire Clubs.

The Discoverer of the Electric Telegraph.—The *Colonies and India* states, that at a recent meeting of the Victorian Royal Society a very interesting paper was read by Mr. R. L. J. Ellery, the Goverment Astronomer, to show that the first practical discoverer of the electric telegraph was a medical gentleman now residing in Malmesbury—Dr. Davy. Dr. Davy is now an old man, and Mr. Ellery proposed to confer on him the honour of electing him an honorary life member of the Royal Society. The society appointed a sub-committee to inquire into the matter, and report as to the best means of doing public honour to Dr. Davy.

The Suakin Cable.—The Eastern Telegraph Company, Limited, states that the steamship Chiltern sailed on Monday from Suez to connect Suakin with the Company's stations at Suez and Aden. With favourable weather the communication should be established in about eight days' time.

Asbestos.—We have received an illustrated catalogue of the Abestos goods manufactured by Mr. John Bell of the Southwark Works. The articles thus produced include paint, millboard, flooring felt, yarn, cloth, engine packing, woven sheeting for steam joints composed of abestos and India rubber, boiler and steam pipe covering and several other specialties. We would recommend Mr. Bell's pamphlet to the attention of engineers.

The "Ross" Primary Battery.—Copy of Mr. Ormiston's report.

Radcliffe Ward, Esq.,
Metropolitan Brush E. L. & P. Co.,
110, Cannon Street, E.C.

Milford Lane,
17*th August*, 1883.

Sir,—I have to report the result of tests made on Ross's batteries, as follows:—The tests carried out were with a few cells, forming a portion of a 60-cell battery, which, according to these tests, is adapted for giving easily 1½ electrical H.P. continually, for at least

12 hours, without falling off in power. The outer cell is about 15 inches by 12 inches by 4 inches, and the porous cell stands inside it, and is about 1 inch wide. The tests were very carefully made and several times repeated to ensure accurate results and avoid chances of error. The following is one of the tests made. The battery was started discharging at 11 a.m., and hourly readings of the current taken as below :—

	Ampères.		Ampères.
11 a.m. ...	14·32	3 p.m. ...	14·32
12 noon ...	13·86	4 „ ...	14·32
1 p.m. ...	14·76	5 „ ...	14·32
2 „ ...	14·32		

which shows for 6 hours a remarkable constancy of the battery. Another test gives the following result :—

	Ampères.		Ampères.
11 a.m. ...	12·908	6 p.m. ...	12·908
12 noon...	12·401	7 „ ...	12·810
1 p.m. ...	12·401	8 „ ...	12·600
2 „ ...	12·401	9 „ ...	12·520
3 „ ...	12·401	10 „ ...	12·220
4 „ ...	12·401	11 „ ...	11·800
5 „ ...	12·908	12 midnight ...	11·370

Mean of 13 hours, 12·430.

This shows, again, a still more extraordinary result, being a run of 13 hours at a constant and steady current of a mean of 12·430 ampères. The consumption of zinc per H.P. was obtained by carefully weighing each plate before and after every run. In the first of the above experiments the consumption per electrical H.P. was 10·95 oz., and in the second 12·75 oz. per H.P. The chemicals employed are of the cheapest kind—sulphuric acid, which is usually such a heavy item in the expense in working large quantity batteries, being dispensed with in this form. The cost of the zinc is, at present prices, rather less than 1½d. per H.P. per hour. The cost of the production of electrical power by this battery is, therefore, remarkably low. Yours faithfully, (Signed) Fred. Ormiston.

Analysis of sample battery waste received from O. C. D. Ross, Esq.

Chemical Laboratary,
12, Langdale Road, Greenwich,
15*th October*, 1883.

*Zinc	39·89
Chlorine	15·00
Oxygen	7·84
Alkaline salts	0·21
Moisture	25·16
Ammonia, nitric acid, &c.	11·90
	100·000

(Signed) James Forrest.

Electric Railways from the West-End to the City.—According to a report made by Mr. L. H. Isaacs, C.E., surveyor to the Board of Works for the Holborn district, the London Central Electric Railway Company seek for powers to construct a railway to proceed by a junction with the line authorised by the Charing Cross and Waterloo Railway Act, 1882, from its terminus in Northumberland Avenue to Piccadilly Circus, and from thence, passing under the new street now in course of formation by the Metropolitan Board of Works, to New Oxford Street, and by way of Holborn, Charterhouse Street, Snow Hill, to Newgate Street and the General Post Office, St. Martin's-le-Grand. The line will be in tunnel for its entire length, and the tunnel itself will be 10 ft. in height. The proposed railway would, it is stated, be a great boon to Londoners generally; and, worked by electricity (if electricity can be relied on as a motor), the tunnel would be free from mephitic vapours, which tend so much to destroy the comfort of those using the underground railways as at present worked by steam. The promoters of the Mid-London Electric Railway seek for powers to construct a railway from the west end of Oxford Street, close to the Marble Arch, to the Royal Exchange, passing under and along Oxford Street, New Oxford Street, Holborn, Charterhouse Street, Snow Hill, Newgate Street, Cheapside, and Cornhill. The line will be in tunnel for its entire length, but it differs materially from the railway last described as to the level below the surface at which it is proposed to construct the tunnel. The promoters of the latter bill failed, the *Daily News* states, to comply with the Standing Order, which provides that a deposit of money on the capital to be raised shall be made by the 14th of January, in the Court of Chancery.

* Equal oxychloride of zinc, 67·00.

The Coming International Health Exhibition.—We learn that at this exhibition, to take place during the present year, electric lighting is to be limited to illustrations of its application to domestic lighting. Its use on a large scale will be practically illustrated by the arrangements made for lighting the exhibition itself.

New Book.—We have received a specimen proof of "A Pocket Book of Electrical Rules and Tables" for the use of electricians and engineers, by John Munro, C.E., and Andrew Jamieson, F.R.S.E.; this book which will be published by Charles Griffin & Co., is uniform in size with Molesworth's well known Pocket Book of Engineering Formulæ, and will form a most welcome addition to the electrical engineers' library. Judging from the proofs before us, the new book is not likely to remain unused on the owners' shelves. The compilation could not have been undertaken by more competent hands than those of Messrs Munro and Jamieson. We shall look forward to the publication of the work.

Electrical Companies' Shares.—On Thursday, at the fortnightly sale of the Stock and Share Auction and Advance Company, the shares of the Jablochkoff Electric Light and Power Company sold at 8s. 6d.; Electric "Sun" Lamp and Power Company fetched from 5s. to 6s., 200 being disposed of; and 500 of the Maxim-Weston Electric Company sold at 5s. A spirited bidding for shares of the Phosphor Bronze Company resulted in sales at £11 11s.

The J. B. Rogers Electric Light and Power Company, Limited.—A petition was presented on Saturday, before Vice-Chancellor Sir James Bacon, for the winding up of this company, the petitioner being Mr. J. B. Rogers, the vendor and promoter of the company, who alleged that the company could not pay its debts, and that it was just and equitable that it should be wound up. Mr. Marten, Q.C., and Mr. Swinfen Eady appeared in support of the petition; Mr. Millar, Q.C., and Mr. Grosvenor Woods, for the company, opposed. The Vice-Chancellor said the petition in his opinion was one which could not be entertained. The company was only eighteen months old, and as recently as June last, the present petitioner had deposed on his oath that it was in a flourishing condition. The company being as it unquestionably was short of money, having laid out its capital and owing debts, the present petitioner and two other persons agreed to subscribe £500 between them to enable the company to carry on and pay its debts, and to wait until better times came. In the month following that transaction, the petitioner presented a petition for winding up. The statute provided that if a resolution had been passed by the company that it be wound up, if it did not commence business within a year, or if it suspended business for a whole year, it might be wound up. But not one of these things existed, and he had never read a more unreasonable petition in all his life. There was no ground whatever in which the court could interfere in favour of the vendor, to wreck this company, which in a twelve month might be a flourishing concern. It would be most unjust and inequitable, because the company was in some temporary difficulties to sacrifice it at the instance of the petitioner, considering what his interests were and what his conduct had been. He dismissed the petition with costs.

DISSOLUTION OF PARTNERSHIP.

Frederick W. Durham, Walter Barrett, M. R. White, and P. Walter Dalton, manufacturers of carbons for electric lighting, at Tramway Yard, Dalston ; so far as regards Frederick W. Durham.

NEW COMPANY REGISTERED.

Lundy Cable Company, Limited.—Capital £10,000, in £10 shares. Objects: To lay and work a cable between Lundy Island and Hartland Point, or between Lundy Island and any other place in England or Wales, and also to lay telegraphic land lines connecting one end of the cable with a signal station on Lundy Island and the other end with a post-office. Signatories, *C. Bath, Swansea, 20 shares; *J. Cory, jun., Cardiff, 20 shares; *J. O. Mesnier, Swansea, 20 shares; *P. Morel, Cardiff, 20 shares; *M. Whitwill, Bristol, 20 shares; F. P. Hacquiol, Cardiff, 10 shares; P. Burton, Swansea, 5 shares. Signatories marked with an asterisk are also directors; qualification 20 shares. Registered 11th inst. by Messrs. Waterlow Bros. & Layton, as agents for Messrs. Hartland, Davies & Isaac, of Swansea.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

River Plate Telephone and Electric Light Company, Limited.—An agreement, dated 21st ult. (filed on the 3rd inst.), has been entered into by this company with the Consolidated Telephone Construction and Maintenance Company, Limited, for granting to the latter 200 fully paid preferred shares, of £5 each, in consideration of valuable and special financial assistance.

W. T. Henley's Electric Light and Power Company, Limited.—At an extraordinary general meeting of the shareholders in this company, held at the company's office, 8, Draper's Gardens, on the 13th ult., certain alterations were made in the articles of association, including the substitution of the following in lieu of article 72: "The board of directors shall be entitled to a remuneration of £250 per annum, exclusive of the managing director, and an additional £100 per annum for every one per cent. dividend declared above 5 per cent. per annum upon the paid-up capital, and such other remuneration as the shareholders in general meeting shall think fit, and such remuneration shall (subject to any directions given by the general meeting) be divided between them in such proportions as the directors may determine." The resolutions were confirmed at a meeting held on the 31st ult., and were duly filed on 4th inst.

Ferranti-Hammond Electric Light Company of Hampstead, Limited.—At an extraordinary general meeting of the members of this company, held on the 19th ult., at 110, Cannon Street, it was resolved:—"That the name of the Ferranti-Hammond Electric Light Company of Hampstead, Limited, be changed to the Hampstead Electric Light Company, Limited." The resolution was confirmed on the 3rd inst., and duly filed on the 7th inst.

The statutory return of this company, made up to the 14th of September, was filed on the 11th inst. The nominal capital is £100,000, in £5 shares, but the only shares at present taken up are the seven subscribed for by the signatories to the memorandum and articles of association.

Yorkshire "Brush" Electric Light and Power Company, Limited. — The resolution passed at the meetings of this company, held on 7th and 27th ult., authorising the voluntary winding up of the company, was duly filed on the 5th inst.

J. B. Rogers' Electric Light and Power Company, Limited.—An Order of the High Court of Justice, Chancery Division, dated 16th November, 1883, was filed with the documents of this company, on the 10th inst., directing the striking out of the register of shareholders of the name of Stanley Woolley Kelsey, of Highfield, Winchmore Hill, and the payment by the company of £15 15s. for agreed costs of the motion.

PROCEEDINGS OF SOCIETIES.

The Society of Telegraph-Engineers and Electricians.

THE first ordinary general meeting of the above society for the session of 1884 was held on January 10th. The minutes of the last ordinary general meeting having been read and confirmed, and the list of new, and proposed new, members read, the Past President, Mr. WILLOUGHBY SMITH, returned his thanks to the members of the society and to the council of the society for the support they had accorded him during his year of office. The past president then handed a cheque for £10 to Mr. J. Munro, being the society's premium for that gentleman's paper on "Metallic Microphones," which had been read in the course of the past year.

The usual votes of thanks having been proposed and carried, Prof. W. G. ADAMS, F.R.S., the new President of the society, read his inaugural address as follows:—

Prof. ADAMS commenced by expressing a hope that the society would in the future take the lead in advancing electrical science. The progress which had been made in the latter had been exceedingly rapid, and in tracing its history he would chiefly have to speak of the period embraced within the last 100 years. Cuneus and Franklin drew prominent attention to electrical science, which resulted in Coulomb, Cavendish, and others coming forward and developing the laws of electricity. The researches of Clerk-Maxwell on the work of Cavendish show that the latter was in advance of his time. The idea of "potential" was clearly defined by Cavendish, and the latter also stated certain electrical units, that of capacity, for instance, being defined as the surface of a sphere of unit diameter; a unit which had merely been modified at the present time by taking the unit radius in the place of the diameter. Cavendish proved that no electricity could exist in the interior of a conductor; and he also proved the law of the inverse squares, and the existence of specific inductive capacity. He compared the relative resistances of iron and salt water by passing discharges through them, the two substances being joined up in multiple arc and their lengths in circuit varied, until it was found that the discharges passing in the two were the same; the results obtained were most remarkably in accordance with more recent measurements. Cavendish employed an electrometer consisting of pith balls suspended at the ends of silken threads. The agreement between the measurements of Cavendish and the more recent and accurate ones of Clerk-Maxwell, may be seen from the following figures:—

Measurements of Cavendish.	Measurements of Clerk-Maxwell.
5·669	5·668
5·754	5·775
6·040	5·910

The torsion balance of Coulomb was the only description of instrument of the kind invented until Sir William Thomson introduced his electrometer. After the experiments of Cavendish, there was a lull in electrical science, and chemistry occupied the attention of the scientific world. In 1800 the experiments of Volta united the two sciences. The experiments of Gilbert and Hallett need not be alluded to. In 1819-20, Oersted gave a considerable impetus to electrical investigation by his discovery of electro-magnetism. In 1820, Ampère enunciated his celebrated laws. The invention of the galvanometer multiplier further advanced the means of electrical research. In 1820-31, the previous work done became consolidated, and the experiments of Faraday and the law of Ohm caused a rapid advance. In 1832 Gauss proposed the system of absolute units. The researches of Joule, Clerk-Maxwell, Thomson, and others, have practically given a new science—the science of "energy." Had the latter been developed in the days of Faraday, the latter would undoubtedly have done what Helmholtz did. Prof. Adams then referred to the action of magnets in inducing currents, as pointing out the various actions which have to be considered in producing a result. Clerk-Maxwell had pointed out the existence of a coefficient of mutual induction; the latter takes place, to some extent, in an outside medium. The sciences of motion, magnetism, and electricity are all mysteriously connected, as proved by experiments; Maxwell, Peltier, and others, had pointed out what the relation between them was. The advantages derived from a system of exact measurement could not be over-estimated, as by means of measurements we could ascertain to what various effects, and to what extent of the latter, any compound phenomenon was due. Thus the action of an oscillating magnet is due to the action of megnetism, the resistance of the air, and to the damping influence of metallic bodies; measurements enabled the relative proportions of these actions to be determined. The march of electrical science is distinctly marked; in the first case we have a great number of isolated facts, then these

facts become connected by definite laws. Faraday, in 1831, showed the important part which *time* played in the development of magnetism in an electro-magnet. As an instance of how certain inventions became developed and certain laws discovered from the attemps to overcome practical difficulties, he would instance the reflecting galvanometer and siphon recorder of Sir William Thomson; these apparatus working by *ripples* of electricity when other instruments required full-sized *waves*. Professor Adams then referred to the labours of the late Sir William Siemens; the latter approached the other sciences through the science of energy, and his great aim in life was the utilization of wasted energy. The laws of Joule, enunciated in 1847, were not at first accepted by the scientific world; but Siemens appeared to have worked on them, and as a result brought forward his regenerative furnace in 1853. In that year he defined what a perfect engine should be, namely, one in which the whole of the heat produced by combustion is utilized. In 1867, steel was first produced successfully by his well known process. His invention of the pyrometer and electrical resistance pyrometer were the result of his researches on high temperatures. In 1867, Siemens and Wheatstone simultaneously announced the principle of the reacting magnet for dynamo machines. This had been previously suggested by Hjorth in 1854, but had been lost sight of. Wheatstone pointed out the advantage of the shunt arrangement. In the past year, electro-metallurgy and the electrical transmission of power had been greatly developed, and Siemens had discussed the question of solar energy. In every form of engine we have substances at two different temperatures producing pressure; as, for instance, more particularly in the hot air engine, the efficiency being—

$$\frac{t - t'}{t \text{ (from absolute } 0^{\circ})}$$

Thermo-dynamics prove that the power varies as the difference of temperature divided by the whole temperature above absolute zero. Super-heated steam, for this reason, considerably increases the efficiency of a steam engine. As a rule, the range of temperature in an engine was 100° C. This would give but ·236 of the available work in a perfect engine. The best results practically obtained were 33 per cent. below this. The actual return in an engine was but 10 to 13 per cent. of the actual energy expended by the combustion of the fuel. Gas engines were comparatively highly efficient, as they were worked at high temperatures. 1500° of temperature were actually obtained. Taking this value, we had 15 atmospheres compressed to three times the volume. If the expansion were allowed to continue to the end, then the volume would be six times what it was at first, and the temperature would be reduced to 16° C. It was, however, inconvenient to go beyond the original volume, the consequence being that the gases issued from the engine at a temperature of 1000° C, which was so much waste. Provided there were no less, 25 per cent. of efficiency would be obtained, but a large amount of heat passed away through the water jacket; this the Crystal Palace experiments proved conclusively. The loss from the gases discharging at a high temperature was especially great in Clerk's gas engine. Siemens considered that the heat from the outgoing gases ought to be communicated to the incoming gas; and in 1860 he made an engine on this principle. Professor Adams next considered the transformation of mechanical work into electricity. Referring to Edison's and Hopkinson's experiments, he pointed out that in the case of direct working machines we have the equation—

$$\text{E C} = \text{C}^2 (a + f + r)$$

where a, f, and r, represent the resistances of the armature, field-magnet, and external circuit respectively. In the case of a shunt wound machine, the equation becomes—

$$\text{E} = \text{C} \left(a + \frac{f r}{f + r} \right)$$

The difference of potential at the terminals of the machine was: $\text{P} = \text{C}_0 r = \text{C}_1 f$.

The energy in heating armature	=	$\text{C}^2 a$
,, ,, field-magnets	=	$\text{C}_1^2 f$
,, ,, external resistance	=	$\text{C}_0^2 r$

The methods of testing employed at the Crystal Palace were then explained.

The tests of the machines, taking the Bürgin C_3 machine as an example, were as follows:—

Electromotive force	82 volts.	
Current	38·18 ampères (mean).	
Resistance of circuit	2·431 ohms.	
,, ,, armature	1·02	,,
Or a total of	3·451	,,

This gives a result of—

$$92{\cdot}843 \times \frac{3{\cdot}451}{2{\cdot}4316} = 131{\cdot}79 = 5031{\cdot}5 \text{ watts.}$$

The actual H.P. by dynamometer was 7·7018, therefore—

$$\frac{5{\cdot}0315}{746} = 6{\cdot}746$$

which represents 87·59 per cent. electrical efficiency.

The useful electrical energy was—

$$87{\cdot}59 \times \frac{2{\cdot}431}{3{\cdot}4516} = 70{\cdot}448 \text{ per cent.}$$

The commercial efficiency was $\frac{70{\cdot}448 \times 87{\cdot}59}{100}$, or 61·7 per cent.

The Edison machine gave an electrical efficiency of 91 per cent., or a commercial efficiency of 81 per cent. Three only of the other machines came as high as 70 per cent. Since these tests Mr. Crompton had remodelled the Bürgin machine, and had considerably increased its efficiency. The latest result from the Edison machine as improved by Hopkinson showed an electrical efficiency of 94 per cent., with a commercial efficiency of 88 per cent.

It was important to remember that the value of the results depended upon the correctness of the electrical units, and probably all the results were 2 per cent. too high as a consequence.

Tests of 40 or 50 lamps were made by the jury at the Exhibition. The candle-powers were measured by a Bunsen photometer, the current being obtained from a Groves' battery, the latter being used in multiples of 5 from 20 up to 40 cells. The Swan lamps, both high and low resistance ones, came out highest at 175 candles; next came the Edison B lamp at 150 candles. The experiments proved that the efficiency of the Swan lamp did not depend upon the resistance of the filament, but upon its peculiar structure.

Professor Adams then referred to the experiments of Marcel Deprez, and also to the Grenoble experiments, on the transmission of power; as the latter were made with the two dynamos separated by an actual distance of 15 kilometres, the results were reliable. It has been clearly shown that the efficiency increases with the velocity of rotation. A commercial return of 50 to 62 per cent. was obtained. The opening of the Portrush Railway was a practical result of the transmission of power experiments, and showed that Siemens in this case was not behindhand in the practical application of the science of energy.

Professor AYRTON, in proposing a vote of thanks to the new president, pointed out the progress that had been made in gas engines, and stated that with the Dowson gas 1·3 lbs. of coal would yield 1 horse-power per hour.

The vote of thanks having been seconded by Mr. C. E. SPAGNOLETTI, the meeting adjourned.

CITY NOTES, REPORTS, MEETINGS, &c.

Indian and Oriental Electrical Storage and Works Company, Limited.

AN adjourned general meeting of this company was held at the Cannon Street Hotel, on Wednesday, under the presidency of Mr. Ernest Noel, M.P. At a meeting held in December a committee of shareholders was appointed to confer with the board of the Electrical Power Storage Company, the parent company, with the view of obtaining concessions in regard to the financial liabilities, and at an adjourned meeting which took place on the second inst., the chairman of that committee, Mr. Bedford, presented a report to the effect that the proposals made to the parent company were declined; that meeting was then further adjourned in order that the committee might be placed in possession of information relating to the agreements existing between the two companies.

The Chairman now said: I will not enter into any detailed criticism of the report that was made at the last meeting by the committee of shareholders, because, since that report was issued, fresh arrangements had been made with the parent company, and those arrangements had met with the complete approval of the committee, and therefore I do not see that it will be of any advantage to occupy the time of the meeting by making any detailed remarks upon the report. Of course, I cannot agree myself, personally, with all contained in that report; but, as you are aware, at the first general meeting I informed the shareholders that the board expected to get what they considered some very considerable concessions from the parent company as regards the hares they hold. In a very few words I will recapitulate what is our position, and what, I trust, will be our position at the close of these meetings. It is proposed first that the 10,000 shares that we had to allot to the parent company shall be deferred shares as far as the dividend is concerned, and further, they will give to us, without any payment a patent of M. Phillipart's, which, as far as we can judge, obviates many difficulties that we found in the practical working of these batteries in India. That is a question that the future alone can decide, whether it is of the value that is supposed or whether it is not. We must wait for that. But at all events it comes to us without payment. The committee of shareholders, as you are aware, were not at all satisfied with those concessions on the part of the parent company, and you also heard a letter from the parent company, in which they, at that time, declined to do anything further. At the same time, I am bound to say that the directors of the parent company, have shown, so far as I have been concerned in negociating with them, the greatest desire to meet any reasonable proposals of this company, and a letter was drafted to them asking whether they could not proceed further in the line of concessions, which letter contained a proposal that the shares of the company should be reduced by 30s. to £3 10s. I must point out to you that the result of that is that their shares, which were 10,000 at £5, meaning £50,000, will now become only £35,000, and that in the case of the liquidation of the company, which I trust will never take place—for I still

have some hopes that there may be a future for these batteries in India—but if we do wind up, the result of that concession is that we have to pay to them £15,000 less than we should otherwise have had to pay, because, without the slightest doubt, we should have had to pay in case of winding up, £30,000, or nearly so, to the parent company, as the difference between their shares, fully paid, and ours only £2 paid. But there is something more in this concession than that, inasmuch as it not only makes us, as I think, a gift of what they had a legal right to, something approaching £15,000, but also gives to us this advantage, that your liability on your shares will be reduced by that amount all round, quite independent of what we owe to the parent company, and as many of the shareholders are not sanguine as to the future of electric lighting or electric tramways through batteries, that is an advantage which everybody must perceive. But I would also add that, supposing we were eventually to find that these batteries are, as many people think, still destined to play a great part in the electrical world, especially in regard to tramways, then, if money be required, more money will easily be raised by fresh issue of capital; so that while reducing the capital we in no wise endanger the future interest of the company, or of the patents it possesses, which some of us still hope will become a really valuable property. There is only one portion of that report which I feel bound to make a very few remarks upon, a portion, I think, which injuriously affects the shareholders, and which, if allowed to remain perfectly uncontradicted would seriously injure your property. It relates to a statement communicated by Mr. Littlewood to the committee. Now I must first say that Mr. Littlewood has himself no knowledge of electricity whatsoever, and therefore his statements can only be taken as regards the facts of the working of those batteries in India. It is perfectly true that those batteries have not succeeded in India, but Mr. Littlewood did not point out, apparently, to the committee, the reasons why those batteries did not succeed. If he had pointed out that the difficulties were not inherent in the batteries themselves, but connected with their mechanical arrangements, which are only adjuncts, it would have shown a very different reason as to the cause of the failure. I will give you one or two instances. The boxes were found utterly inefficient. Has that anything to do with the inherent value of the invention, whether good or bad? Again, there were a large number of plates sent out, which were overcharged, we have reason to believe, before they were sent; this might have been by accident, but did it effect the inherent value of the batteries? The whole underground system in Bombay by which they were utilized were such that I fancy no system could have succeeded. Was that anything to do with the batteries. Again, I would mention that those who had to deal with them had not the proper system of charging those batteries. Therefore, I think, I am bound to state, in the interests of the shareholders, that the causes which led to their failure in India —and there is no doubt that they did fail; we found we could not work them economically—had nothing to do necessarily with the inherent value of the batteries, but were causes which may be described as mechanical difficulties, which may or may not be overcome. The correspondence between the secretary of the company (Mr. H. Cleland Heywood) and the General Manager of the Electrical Power Storage Company, relating to the concessions mentioned, was here read as follows :—

"19, Great Winchester Street,
"15th January, 1884.

"To the General Manager of the Electrical Storage Power Company, Limited.

"Dear Sir,—With reference to the negociations which have recently taken place between us, particularly since the appointment of the committee of shareholders, I am requested to inform you that it would facilitate the settlement of all questions between the board and the dissentient shareholders, and secondly, of all possible questions between the two companies, excepting the question of accounts for batteries, which remains open for mutual adjustment as per your letter of the 12th December, 1883, if the following proposals be agreed to by your company, as in addition to those contained in the former agreement of the 13th December last, viz.: In addition to the deference of your company's shares as provided by the agreement of the 13th December last, the Electrical Power Storage Company will assent to a reduction of the nominal amount of all the shares of the Indian and Oriental Company, both ordinary and deferred, from their present figure of £5, to £3 10s. each, and the necessary proceedings will be taken for this purpose, your company accepting 10,000 of such shares in lieu of the 10,000 specified in the agreement. If any technical difficulties should arise in carrying out such reduction of capital, then between the two companies it is agreed that the 10,000 shares shall, for all purposes dealing with the rights of the shareholders, stand at those figures, and all necessary acts and deeds should in that case be executed in order to give effect to this intention. The above additions to the recent agreement will, we believe, effect an arrangement of all present difficulties, and I shall be glad to receive a letter from you, signed by the authority of your Board, agreeing thereto. It will, of course, be advisable to embody these arrangements in a more formal agreement to be settled by our solicitors, or, in case of difference, say, by Mr. Buckley, of Lincoln's Inn; but as the committee of shareholders will propose to act upon these arrangements by expressing their assent to them at the meetings on Wednesday, it will of course be understood that this letter and your acceptance, when received, are to be binding between the two companies, and the further agreement will be a matter of convenience and formality only.—I am, dear sir, yours faithfully, "H. Cleland Heywood, Secretary."

"4, Great Winchester Street,
"*15th January*, 1884.

"To the Secretary of the Indian and Oriental Electrical Storage and Works Company, Limited.

"Dear Sir,—I have to acknowledge your letter of this morning's date, and in reply beg to state that I am authorised by my directors to announce that they accept the terms therein proposed, and they will execute any further necessary documents to that effect which may be approved by their solicitors, or settled, in case of difference, by Mr. Buckley, of Lincoln's Inn.—Yours faithfully, "T. M. Collet, General Manager."

The Chairman then moved the adoption of the report of the directors, and the statement of accounts, which were submitted to the first meeting in December.

Mr. Bedford seconded the motion, which was carried unanimously.

The auditors—Messrs. Deloitte, Griffiths & Co.—were then re-elected.

Mr. Bedford said shareholders who were present at the last meeting would remember that the committee were very desirous of obtaining a postponement for three weeks, and that, after considerable consultation and discussion, it was found that they could not possibly be granted more than two weeks, in order that the resolution to come before the extraordinary general meeting might be passed, They desired that length of time because they were fully impressed with the importance of the duties which they had to discharge, and they did not wish to hurry through the work and present a report that was imperfect; and they further felt that if they had longer time at their disposal they would probably have had an opportunity of again meeting the parent company, when perhaps they might arrive at some compromise enabling them to present a report to the shareholders putting aside all difficulties and causing the company to go on harmoniously. As a matter of fact, they did have some talk with the general manager of the company, and made some propositions, but time ran short, and it was imperative for them to present their report; the negociations at that time were in such a position that they could not speak of them, and there was a possibility of their falling entirely through; consequently they were bound to make the report they did. Within about 36 hours after the report had been in the hands of the shareholders they received an intimation that the parent company was prepared to make certain concessions which they would like them to consider and pass a decision upon. What those concessions were, they had already heard from the chairman, and he could only say that they appeared to the committee, after due consultation and consideration, to be all that they could reasonably ask, and they came to the decision that they would support them, and if needful, in support use the proxies entrusted to them. In connection with the directors, they had succeeded in obtaining what, at the outset, he did not think they would have accomplished. Supposing they went into liquidation at once—and he might say the committee were opposed to such a course, for they thought there were very good grounds for hopes for the future—they could not possibly have to pay much more than 15s., and that was the worst possible phase the case could assume. But they did not anticipate liquidation; they desired to pursue that waiting policy which the chairman indicated at the first meeting, to husband their resources, cut down their expenses to the very lowest possible point, and enter into no experiments, but only actually do that which is needful for keeping the company alive, and then, when the time came when they could see their way clear to enter upon further business with solid grounds of success, he did not doubt that every shareholder would be willing to respond to any call. He thought the chairman would pledge himself that the board should not make any further call before calling them together and explaining fully what the money was required for. They should be thankful that they had got out of what promised to be a very ugly business. The committee, had there been no compromise, would have come prepared to fight, and there was little doubt in his mind that if liquidation had resulted, litigation would have followed, with the result that every penny would have to be paid on the shares.

The Chairman repeated the promise he had given at a previous meeting, that before undertaking anything that would require a fresh call, the shareholders should be called together and their sanction obtained. There were two vacancies on the board of directors, and he would like two gentlemen of the committee to take the vacant places. They (the directors) were asked to conduct the affairs of the company, and yet not even be allowed the payment of those travelling expenses incurred in attending the meetings of the board; that was the proposal made, and he thought some shareholders who were in London ought to come upon the board. The next general meeting would probably be in July, and he should then feel bound in his own interest to make some fresh arrangements, but in the meantime he should do his best to conduct the affairs of the company in the interests of the shareholders, although he could not pledge himself to remain beyond that time in what he felt to be a very invidious position.

An extraordinary general meeting was then held, at which the resolution passed at the previous extraordinary general meeting, deferring the dividend on 10,000 shares held by the Electrical Storage Company, was confirmed, on the motion of the chairman, seconded by Major Strutt.

Votes of thanks to the committee of shareholders and to the chairman terminated the meeting.

The West Coast of America Telegraph Company, Limited.

ANTICIPATING the annual report and balance sheet, with a view to the distribution among the shareholders of some portion of the cash profits of the company now lying at the bankers of the company in London, the directors have the pleasure to announce that, according to cable advices, the gross earnings of the company for the year ending 31st December last, amount to an estimated sum of £58,000, against the sum of £38,891 0s. 4d. for the corresponding period of the previons year, or an increase of somewhere about £19,000.

It is of course impossible to give the exact working expenses for the year, but the directors calculate that there will be no large or appreciable increase upon the actual expenditure of the previous year, which according to the balance sheet, and including the expenditure in London, amounted to a total of £19,240 11s. 9d. To this sum has to be added the interest on the company's fixed debentures, which has been paid as usual, viz.: £12,000, making the total estimated expenditure, with the debenture interest added, into a sum of £31,240 11s. 9d., or, in rough figures, and making allowance for an increase in expenditure for the past year, say a sum of £32,000, which amount, deducted from the estimated gross earnings, £58,000, will leave a balance of nett profit on the year's working of a sum of about £26,000.

In view of the result of the year's working—a result which the directors regard as satisfactory—and pending the settlement of balances with other companies, and the final adjustment and audit of accounts on the West Coast and in London, the directors have this day declared, out of the profits for the year, a dividend at the rate of 4 per cent., or eight shillings per share on the ordinary shares of the company. This dividend will absorb a sum of £12,000—leaving the balance to be dealt with hereafter, or on the issue of the annual report and balance sheet.

To cope with the increase of business, and in order to give greater efficiency to the company's service, the staff on the coast has been augmented by sending out, since the last report was issued, some additional clerks. Any increase of expenditure involved in taking this step, which was alike judicious and unavoidable, will, however, be partly met by economies in other directions.

As a matter of information the directors regret to state that the company's claim is not yet arranged, but it has at length been placed prominently before the Chilian Government, and a satisfactory settlement is still hoped for.

The company's repairing steamer has been efficiently maintained, and the electrical condition of the company's cables leaves nothing to be desired by the board.

The cables and land lines of the West Coast of America Telegraph Company, Limited, are:—Cables:—Valparaiso to Serena, 219·03 nautical miles; Serena to Caldera, 215·34 nautical miles; Caldera to Antofagasta, 229·00 nautical miles; Antofagasta to Iquique, 250·50 nautical miles; Iquique to Arica, 128·35 nautical miles; Arica to Mollendo, 146·42 nautical miles; Mollendo to Chorrillos, 510·08 nautical miles. Land lines:—Chorrillos to Lima, 11·00 nautical miles; Lima to Callao, 7·00 nautical miles. Total, 1,716·72 nautical miles.

The Western and Brazilian Telegraph Company, Limited.

THE report of the directors for the year ended 30th September 1883, to be presented at the 11th ordinary general meeting of the company, states that:—

The total earnings amount to £112,706 11s. 0d., a decrease of £2,463 5s. 11d. compared with last year, caused mainly by the interruption of the Brazilian Submarine Company's cable, referred to below. The working expenses for the year amount to £61,127 19s. 11d., as against £61,919 3s. 8d., a decrease of £791 3s. 9d. These expenses include £1,800 for depreciation of s.s. *Norseman*, an item which did not enter into last year's accounts.

Since May last the new steamer *Viking* has been in commission, and has proved well adapted for the service, having effected some important repairs.

Including the amount brought forward from last year, the balance to the credit of the net revenue account is £29,369 13s. 0d., out of which amount the board has already paid an interim dividend at the rate of 2½ per cent. per annum for the half-year to 31st March, amounting to £13,108 2s. 6d. It is now proposed to pay a further dividend (also free of income tax) at the same rate to 30th September. This will absorb a further sum of £13,108 2s. 6d., leaving £3,153 8s. 0d. to be carried forward to next year.

In consequence of the continued competition by the Brazilian Government, the board has at length found it necessary to reduce the tariff over the cables of this company to that of the Brazilian land lines. This reduction came into force on the 1st September last, and the preference accorded to the company's lines by the public has produced satisfactory results.

On the 22nd September, the cable of the Brazilian Submarine Telegraph Company, Limited, between St. Vincent and Pernambuco was interrupted. Communication was not restored until the 4th December. The duplication of its cables which the Brazilian Submarine Telegraph Company has decided to carry out will give to this company increased security.

N.B.—Shareholders desirous of dividing their shares into preferred ordinary and deferred ordinary shares are reminded that this can be effected between the 1st January and 30th April in each year.

The Australasian Electric Light, Power and Storage Company, Limited.

THE ordinary general meeting of this company was held on Monday at the offices, Coleman Street. Mr. Randolph C. Want presided.

The Chairman, in moving the adoption of the report, reviewed the operations of the company from the beginning. They had, before issuing the report, conferred with some of the largest shareholders on their position and prospects, and they had fairly satisfied those gentlemen as to the future of the company. The creation and development of such a business as that of the company must have involved outlay, with seven large and important colonies "to tackle." It was anticipated at the outset of the company that they would be able to dispose of their patents and to accumulate profits in that way, but very shortly after the formation of the company the enthusiasm respecting the electric light which had previously existed ceased, and they found that there was no chance of selling their patents. Sir Julius Vogel had been to the colonies on behalf of the company, and though that gentleman had not been able to dispose of their patents, he had brought their advantages before all the principal colonies, and it was through the instrumentality of Sir Julius Vogel that the company were at that moment working for the Governments of New South Wales, Victoria, and Queensland. He had mentioned this especially as some of the shareholders had asked whether Sir Julius Vogel had not been paid excessively—an opinion which he (the chairman) certainly did not share. The colonists were a little nervous at first as to adopting the light, and had desired that the company should first prove its advantages. Installations had been put up, and though he did not think they had done any work on which profits had not been realised, those profits had been absorbed in other directions. They had had to pay very heavily for the plant, but they had now contracts under which they would obtain what they required on terms which would give them profits. He did not wish the shareholders to think that they were going to "rush into fortunes," for the enterprise was of a nature which must go on steadily; but it would be wrong to estimate the prospects of the company by the measure of their success in the past. The same ordeal which the electric lighting enterprise was now going through had been experienced by gas, water, canal, telegraph, and other companies, but in the end investors in those undertakings had been repaid. After referring to negociations which were pending for an amalgamation of the company with another company in Victoria, he alluded to the expenditure which had been incurred by the company, and stated that there had necessarily been a large amount of what at first was "dead" work. They now, however, had no installations to put up for exhibition, as they had them in every one of the colonies where they worked, and they were able to point to them as admitted successes. The directors had made a call with the intention of continuing the work; and the orders they now had in hand, and the promises of work, led them to believe that there was a good field before them. They intended to reduce expense in every direction that they possibly could. Their latest advices from their agents were very encouraging; and they would have a cheaper and improved plan to work with.

Mr. J. I. Cater having seconded the motion, a protracted discussion followed, in the course of which the amounts paid for the patents and the expenditure generally were regarded as excessive, as was also the remuneration paid to Sir Julius Vogel. It was also contended by some shareholders that the right course for the company to take in the circumstances in which it was placed would be to wind up.

The Chairman replied, and regretted the absence of Sir Julius Vogel through an attack of gout. He repeated his opinion that Sir Julius Vogel had not been paid too much for the work he had done. As to the question whether or not they had a business which, in the opinion of the directors, would become a paying one, he thought that the best answer was that the directors were some of the largest shareholders. They held 1,250 shares, on which, of course, they would have to pay the call, and that fact was the best indication of their belief in the prospects of the company. The prospectus set out the sums which were to be paid for the patents. The directors had given up half their fees.

The Secretary (Mr. J. H. Duncan) having given the details of the home and colonial expenditure at present,

The Chairman stated that a calculation had been made showing that if they now sold £25,000 of plant a year they would cover every possible expense. The total expenditure last year was £14,000, but of that amount £7,000 was for "dead" work; and he certainly did not think £7,000 was too heavy an expenditure in such a company. As to the appointment of a committee, he thought the same end would be attained and in a better manner by increasing the number of the directors. He afterwards alluded to the action against the Electrical Power Storage Company for the return of the money paid to them by the company, and to the appeal which they had decided on making.

The motion was eventually carried *nem con.*, the four shareholders who at first voted against it withdrawing their opposi-

tion; and it was afterwards resolved to ask Mr. Robert Hammond and Mr. Pankard to join the board. The auditors were re-elected.

The "Pilsen-Joel" and General Electric Light Company, Limited.—The directors deny the assertions made in a circular, issued in December, by J. G. Osborne & Co., respecting the position of the company. They say it is untrue that the liabilities of the company amount to £117,502 2s. 7d., the actual liability at the date of the last balance-sheet being £1,577 2s. 7d., and £115,925 representing the paid-up capital. By the advice of counsel, the directors are taking steps to obtain an injunction against J. G. Osborne & Co., to restrain them from further publication of their circular, on the ground that it contains false and libellous statements.

German Union Telegraph.—The dividends for the year 1883 on the 5½ per cent. original preference shares, as also an interim dividend of 4 per cent. upon the dividend due in respect of the original stock, on the 1st May of this year, are payable at the London Agency, 66, Old Broad Street, E.C.

Lancashire and Cheshire Telephonic Exchange.—An interim dividend, at the rate of 6 per cent. per annum, is payable on the 22nd inst.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending 11th January, 1884, were £2,753, after deducting the "fifth" of the gross receipts payable to The London Platino-Brazilian Telegraph Company, Limited.

The Brazilian Submarine Telegraph Company, Limited. The receipts for the week ended 11th January, amounted to £3,500.

NEW PATENTS—1884.

923. "Laying electrical conducting wires in the ground and an insulating compound for electrical purposes generally." H. J. ALLISON. (Communicated by J. Greives and J. H. Bleoo.) Dated January 8. *Complete.*

927. "Electro-gilding." J. RECORD. Dated January 8.

933. "Dynamo-electric and electro-dynamic machines." S. J. GROVES. Dated January 8.

974. "Electro-motors." S. PITT. (Communicated by L. W. Stockwell.) Dated January 8.

988. "Arc lamps." J. BROCKIE. Dated January 8.

1002. "Electric signalling apparatus for communicating between trains on railways." A. M. CLARK. (Communicated by J. P. Rogers and J. E. Upham.) Dated January 8.

1041. "Regulating electric currents when used to propel pendulums." S. D. MCKELLEN. Dated January 9.

1065. "Regulators for dynamo or magneto-electric machines or generators." H. J. HADDAN. (Communicated by the Bain Electric Company.) Dated January 9.

1077. "Telephone transmitters." G. L. ANDERS. Dated January 9.

1098. "Means or apparatus for regulating the speed of dynamo-electric machines used for distributing electrical energy." J. C. MEWBURN. (Communicated by M. Deprez.) Dated January 9.

1100. "Primo-secondary batteries, or batteries which partake of the nature of primary and secondary batteries." G. G. André. Dated January 9.

1108. "Telephone exchange systems." W. R. LAKE. (Communicated by J. W. Duxburg and H. W. Breckenridge.) Dated January 9.

1124. "Galvanic batteries." R. CHARLTON. Dated January 10.

1157. "Induction coils." J. SWINBURNE. Dated January 10.

1158. "Covering of the core of submarine telegraph cables." H. G. BAKER. Dated January 10.

1176. "Dynamo-electric machines." J. SWINBURNE. Dated January 10.

1178. "Manufacture of incandescent electric lamps or glow lamps." J. SWINBURNE. Dated January 10.

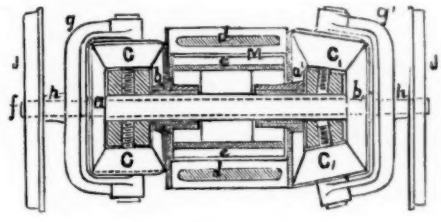
1197. "Utilisation of electricity for the propulsion and traction of vehicles." W. R. LAKE. (Communicated by M. de Kabath.) Dated January 10.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1883.

2350. "Electric cell or batteries." N. C. COOKSON and J. SWINBURNE. Dated 9th May. 4d. Relates to secondary cells or apparatus for storing electrical energy; to apparatus connected with the charging and discharging of the same, and to primary or ordinary cells which are not necessarily recharged by electricity. (*Provisional only.*)

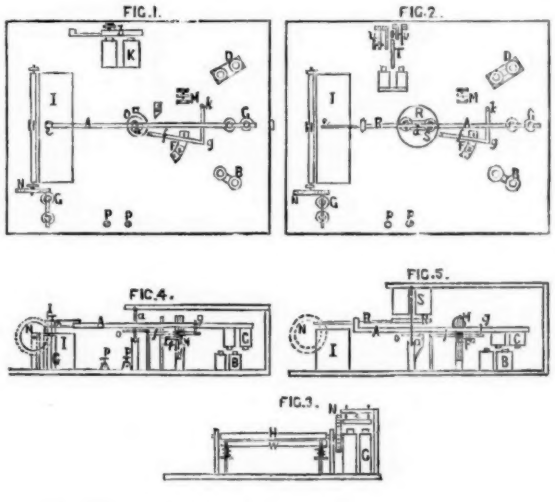
2395. "Contact boxes on electric railways." W. E. AYRTON and J. PERRY. Dated 11th May. 1s. 2d. Relates to electrical switches for the "Telpherage" system, by means of which the blow given by the passing train for the working of the contact boxes is avoided. The contrivances are some of them suitable for the series system and some of them for the parallel system of the electric transport of goods and passengers.

2437. "Differential gearing applied to electric motors and vehicles." F. WYNNE. Dated 15th May. The fig. shows one form of this gearing. The movements in opposite directions of two discs is obtained by making the armature, *d*, move in one direction, and the field magnets, *e*, in the other. *a* and b_1, are moved by the rotation of *e*, to which they are mechanically connected, and *b* and a_1, by the rotation in the opposite direction of *d*,



to which they are mechanically connected. The axis of the carriers are connected through the arms, *g* and g_1, to bosses, *h*, h_1, and these can be respectively connected rigidly to *f* by clutches, or other convenient attachment not shown in the fig.; but when one clutch is connected the other must be loose, and when the clutch attaching, say, h_1 to *f*, is connected, the carrier, *c*, and arm, *g*, must be fixed, say, to the body of a tramcar, and *h* free from *f*.

2440. "Apparatus for reproducing at a distance the facsimile of writing characters, &c., by electricity." A. T. COLLIER. Dated 15th May. 6d. Fig. 1 shows a top plan of the mechanism of the transmitter. Fig. 2, top plan of the mechanism of the receiver. Fig. 3, shows an end elevation of the receiver and transmitter. Fig. 4, elevation of the pen or marking arrangement of the transmitter, and Fig. 5, that of the receiver. A shows the pendulum pivotted at *a*. B is an electro-magnet which causes the oscillation of the pendulum, A. C is another electro-magnet connected with or forming part of pendulum, A. D is an armature forming the magnetic field with C, as hereafter described. *e* is the pen or point. F is an automatic switch. G an electro-magnet for moving the paper. H, roller to carry the paper. I is a table for supporting the paper. J is an automatic current reverser for reversing the line current. K is an electro-magnet to make and break the local current by means of the armature, L, as hereafter described. M shows an arrangement for making a line current at a given



time, as hereafter set forth. O is a spring to actuate the pendulum. P P, are terminals for connecting the poles of the local battery. N is a ratchet wheel for working the paper roller, H. In the receiver at fig. 2, R shows a circular armature attracted by electro-magnet, S. T is a polarised relay; U and V are current breakers actuated by the relay, T. W, fig. 3, is a spring roller to hold the paper against the roller, H. The action is as follows. The local current being connected with the terminals, P P, the arm, *f*, of the switch being on the first section of F, magnetises B and C, which are in the circuit; this causes the electro-magnets, B and C, to attract each other (their poles being arranged accordingly), and thereoy moving the arm, *f*, of the switch, F, from 1 to 2, by the pendulum, A, pushing the arm, *f*, by means of the pin, *g*, thereby demagnetising B and C, and magnetising G, which is in circuit with section 2, and causing its armature, *h* (to which a

suitable pawl is connected) to move the roller, H, by means of the ratchet wheel, N, after which the pendulum continuing its onward motion, pushes the arm, *f*, of the switch to the insulated portion, *i*, so as to break the current, the pendulum then swings back, and when it arrives at the magnetic field, D, or nearly so, it pulls the arm, *f*, of the switch, F, over from *i* to section 1 by means of the arm and pin, *k*, thus in its return again moving the paper as before. Upon the pendulum arriving at the field, D, it is held there by the magnetic force of C, thus forming a catch, and during its course towards D comes in contact with the spring or piece, M, makes a contact in the line wire, and at the same time reverses the current by means of J, which latter returns to its normal position when C leaves D. The transmitter pendulum is held in this latter position until the pendulum of the receiver arrives at its magnetic field, D, when it in its turn makes a second contact by means of M in the line wire, thus completing the circuit and magnetising K and T, which are in circuit with the line current, the effect of which is to demagnetise C, thus allowing pendulums to swing back and operate as before, and thereby obtaining a perfect synchronous movement of the pendulums. It will be seen that the current reversed and the polarised relay are rendered necessary on account of the dual effect the line current has to perform, viz: regulating the pendulums, and also producing the pulsations of the pen or point holder. The writing or marking is effected by the pens or points, *e*, connected to the pendulums, A, that of the transmitter is shown at fig. 4, which on passing over or along the raised character on the paper causes a contact at *m*, as will be clearly seen on reference to this figure, and upon making such contact magnetises the polarised relay, T, and forms connection with a local battery (by preference) and magnetises *s*, which attracts E, and causes the pen or point, *e*, of the receiver to mark the paper by any known method. The raised characters are produced by means of a stylus used as a pen or pencil, with suitable pressure applied thereto, the paper being placed on a soft pad.

CORRESPONDENCE.

Electric Lighting of Trains.

Your leader last week respecting the electric lighting of railway trains does not eulogise accumulators. I have had practical and continuous experience of them since their introduction into this country, and the opinion I have formed is that they are perfectly reliable if used properly.

I have had charge of the electric lighting of the Pullman express train, running between Victoria and Brighton, for about two years, and during that period the electric light has not been replaced by any other illuminant for a single evening. The original Faure accumulators were certainly but moderate. The Sellon-Volckmar cells were, however, a great improvement. Of these latter I obtained 35 in December, 1882, for the Pullman train, and my records tell me that up to the present time only five defective cells have been returned to the Electrical Power Storage Company. None of the others have had new plates, nor have they had either acid or distilled water supplied to them for nine months past. They have been simply given plain water to replace that lost by evaporation. The cells are travelling between Victoria and Brighton daily, and, as you may imagine, do not receive very tender treatment; but notwithstanding this, they appear to be almost as good as when first obtained. I believe that if accumulators are worked within their capabilities they will last a very long time—probably years; but if pushed and made to work too hard their lives are short.

With regard to the second train we have lighted by electricity, in accordance with the patent of Mr. Stroudley and myself, I would say the accumulators there have been in use, and the train running successfully with the light going up to a maximum of nine hours per day, since 19th ult. These accumulators, as charged by the motion of the train, will, I feel satisfied, last a very long time indeed, for the reason that it is found only necessary to charge and discharge them with a comparatively low current—not exceeding 30 ampères.

E. J. Houghton,
Telegraph Engineer, L. B. & S. C. Ry.

Telegraph Department, L. B. & S. C. Ry.,
London Bridge Station, S.E.,
15*th January*, 1884.

The Theory of the Gramme Machine and Unipolar Machine.

M. de Wolffers complains in your last issue that scientists—even Dr. St. Doubrava—"fail to perceive the absurdity of considering the interior wire of the Gramme-Paccinotti ring as merely so much useless resistance," and M. de Wolffers shows diagrams of some small magnet combinations, from which he wishes to demonstrate that the copper wire inside a Gramme ring is not idle.

I have failed to find in these diagrams any contradictions of Dr. St. Doubrava's (or any other) theory, or the description of the Schuckert machine, as given in your JOURNAL for October 6th, 1883, nor has M. de Wolffers exposed, explained, or disproved "the fallacy of the otherwise admirable treatise on electric illumination published by your contemporary, *Engineering*."

The mere fact that Mr. Cunynghame (the able barrister) in his work on "The Law of Electric Lighting," concurs with M. de Wolffers, does not set aside theories which are the outcome of practical consideration and experiments made with machines in practical use, instead of conclusions drawn from iron filing diagrams, taken from small magnet combinations invented by Büchertisch.

It is very easy to make iron filing diagrams of any small magnet combination, since each particle of iron filing induces magnetism in the next one, and lines of magnetic force can then be formed at pleasure; but whether these lines of force exist when the iron filings (attracting the lines of force) are not made use of, or whether the lines of force produced and shown by the iron filings, represent the actual lines of force between the large and powerful inducing magnets and a ring armature in motion (the latter weighing at least 25 lb.), can only be understood when carefully considering and applying the elementary laws of magnetic induction to such large masses of iron, shaped in forms, as actually in use. The lines of force shown by M. de Wolffers in his letter, in fig. 2, can only be got in a combination of such a small size as his illustration. The feeble lines of force inside the magnetized iron ring will not pass through a large space without the use of iron filings.

Had M. de Wolffers been content with the demonstrations of his ideas of magnetic lines of force, I should not have asked your indulgence and space; but he made the following characteristic assertions without giving any facts in support, viz.:—"That the machines of several makers named, and my own machine, 'The Heinrichs,' are not more efficient than the ordinary Gramme, and that the advantages obtained by the use of flat rings and encircling poles are, to say the least, 'microscopical.'" These assertions show at once M. de Wolffers' ignorance on the subject; he seems not to have carefully read your JOURNAL, nor your contemporary mentioned by him, nor compared the reports of the efficiency of my machine with those of the Gramme. I will here only mention that my machines supply current of over 50 watts per lb. of copper wire employed on the machine. The high efficiency of my medium can be understood from the explanation you were good enough to put before your readers on the 1st of November, 1880, the perusal of which I suggest to M. de Wolffers, and from which he can see that the wire inside a Paccinotti-Gramme ring is not always idle, but may under certain conditions not only be useless, but detrimental to the generation of current on the armature.

Charles F. Heinrichs.

London, 14*th January*, 1884.

Van Rysselberghe's Telephone System.

Having read in the REVIEW accounts of the working of Van Rysselberghe's system of telephony on the telegraph wires of the Belgian and of the Holland Governments, I was desirous of knowing what were the peculiar merits of that system, and for this purpose I procured copies of his several specifications at the

British Patent Office. The first patent is dated March 17th, 1882, from which I now make a few extracts.

The inventor says, "where a network of wires exists which are employed for ordinary telegraphy, it has hitherto been extremely difficult to practically employ one or more of these wires for telephonic communication, owing to the injurious effects upon the telephone of the induced, derived, or "foreign currents" which each wire of the network imparts to all the others."

"The object of the present invention is to remedy this defect and to enable one or more wires of the system to be employed for telephony whilst the other wires of the system are simultaneously employed for telegraphic communication."

"The following are the means to be employed :"—

"1st. The intensity of the undulatory current of the microphone and induction coil is increased by employing an electric source of extremely feeble internal resistance, much less than that of the primary batteries now employed for telephonic circuits."

"2nd. Microphones with multiple contacts and those coupled in quantity, are used."

"3rd. The small carbon cylinders of the microphone, except at their points of contact, are covered with a metallic coating to render them better conductors."

"4th. A key to put receiver out of circuit."

"5th. The construction of the coils of the telephone receiver and the secondary circuit of the induction coil is modified to considerably increase their resistance."

"The electromotive force must satisfy this condition (stated in the first means), and it is proposed to employ a Planté's secondary battery and Faure accumulator, or the result may be obtained by the use of a large number of ordinary Leclanché or other battery cells (say 20, 30, or 40) coupled in quantity so as to reduce the resistance."

The first claim in this patent reads as follows :—

"The several means herein described for the improvement of telephonic communication."

Those several means—five in nnmber—are as above given.

In regard to the means first stated—*i.e.* "the employing an electric source of extremely feeble internal resistance."

The inventor says in his specifications that a large number of Leclanché or other battery cells (20, 30, or 40) coupled in quantity, will produce the desired result.

Is it possible that any one can even think that a claim for such "*means*" can be valid, for have not Leclanché and other battery cells in large numbers, even up to 60 cells, coupled for quantity, been used for telephonic purposes ?

In regard to the "2nd and 3rd means," *i.e.*, "microphones with multiple contacts coupled in quantity," I make the following quotation from my patent, No. 4905, 9th Nov. 1881. "In my first form of microphone (resistance 1·4 ohms) I use a number (12) of pencils of hard-coke carbons; the ends of the pencils are held loosely in blocks of carbon. A block of carbon, to which is connected one terminal of the primary wire of an induction coil, forms the centre of a series of blocks (12 in number), placed around the centre block, about two inches from it; this periphery of blocks is connected together by any good conductor, to which is connected one pole of the battery, the other pole thereof being connected to the primary wire of the induction coil; the centre block has a series of holes (12), around its circumference, and each of the surrounding blocks has a hole in it, in which lies loosely one end of a carbon pencil, the other end thereof lying in a hole in the centre block. Each pencil is covered with a metallic sleeve, which must not be in contact with any of the blocks—this metallic sleeve increases greatly the conductivity of the pencil, and also increases its specific gravity, both of these effects being advantageous." In my specification I did not claim either of these devices, for the very good reason that multiple contacts connected for quantity, and carbons with metallic sleeves had been in use, and their use was public property.

With regard to the 5th means, *i.e.*, "coils of great resistance on the telephone receiver and great resistance of the secondary circuit," is it possible that the resistance of such coils is subject matter for a valid patent. I have seen in use coils of 375 ohms resistance for the seconday wire, and of 150 to 175 ohms resistance on the receiver.

It seems to me that the two principal and most important *means* claimed by Van Rysselberghe to produce the great results are the multiple microphone, with metalled carbons connected for quantity, and I must express my gratification that the *means* I described in my patent above referred to, have enabled Van Rysselberghe to obtain such happy results; and, although at the time of preparing my specification I was not aware that those *means* could produce such, I may say, wonderful and beneficial results, yet, according to the dicta of the late Sir George Jessel, Master of the Rolls, I am the inventor of that system.

In conclusion, I will remark that I believe it is good law that a patent is void if any one or more of the claims are for an old device.

W. C. Barney.

January 14th, 1884.

Bichromate Batteries.

I notice in your last issue, of January 12th, 1884, a correspondent "F. T." who is in difficulty with his Bichromate battery. Having had a great deal to do with this form of battery, I venture to advise him on a few important points. That he should see that the zincs of each cell are carefully insulated from the carbon, also that if he joins his cells together with gutta percha covered wire, he should examine the wires carefully as the wire inside the gutta percha of one of them may be broken.

If these main points are looked to, he will find that the battery will work properly. With regard to the solution he uses, I should advise him to mix it by M. Trouvé's method which he will find fully explained in the ELECTRICAL REVIEW for April 28th, 1883. It would be much more economical if "F. T." was to use one zinc plate between two carbon plates; the consumption of zinc would be so much less.

M. T. A. P.

January 14th, 1884.

Full of sympathy for F. T.'s anxiety concerning his battery, may I suggest that having sometime ago experienced the same annoyance with my watch, which stopped after several years perfect working, I set matters right by sending it to a watchmaker. I have no doubt if your correspondent sends his battery to any of the makers, they will understand and be able to explain the cause of the stoppage.

Armand Levy,
Maker of the Trouvé Battery.

252 Goswell Road.
January 14th, 1884.

Barnett's Accumulator.

With reference to my secondary battery and system of distribution.

I am aware that there is no novelty in *proposing* to place secondary batteries in houses, coupled in series, governed by an automatic cut-out, and charged from a common centre, but I am not aware of any automatic cut-out but my own by which it is possible to accomplish it.

The minds of electricians have been, for a considerable time past, exercised to devise an arrangement by which it (said proposition) could be accomplished, but all the arrangements of which I am aware have met with signal failure. I only know of three methods which have been devised. The first was that of Edison, for cutting out the cells when the gas began to be liberated, through pressure on a tympanum : but this arrangement, although it will "cut-out," will not

"put in" again, as the gas, although liberated during charge, will not be absorbed during discharge. The second was that brought into prominence (financially) by Brush.

This depended on the action of one or a number of solenoids or magnets actuated by variations of E. M. F., and depended on the pre-supposition of a battery which had a constant continuous rise and fall of E. M. F. during charge and discharge. Even if consumers were willing to put up with batteries of this bilious tendency, it could not be used, for directly the charging current flows through them, gas is liberated, and the counter E. M. F. immediately goes up to the E. M. F. of the gases; therefore directly the current was put on, it would break, and as soon as the film of gas was absorbed, put in again, so keeping up a regular contact breaker action.

The third was that proposed, I think, by Messrs. Gladstone and Tribe, in their interesting and instructive papers. It depended on variations of density of the solution, owing to liberation and absorption of sulphuric acid during charge and discharge, through sulphating. Even at the best, batteries having this tendency are very poor indeed; but the chief obstacle to the adoption of this method is, that they have a tendency to throw the dense acid to the bottom of the cell, so that the density of the solution is continually varying; therefore it is impracticable, for one could hardly send a man round every day to stir up the acid.

I do not wonder at the opinion which the learned Dr. Schellen has given, if it was founded on his experience with the batteries hitherto in the market; if he would come and see mine, I believe his opinion would be altered.

I thoroughly agree with you when you say that "the objections to the application of secondary batteries have been chiefly of a mechanical nature," and I believe that you will see that my battery owes its excellence solely to improvements in mechanical construction.

With reference to the internal resistance.

When I say that the batteries are practically dry, I do not mean that you could turn them topsy-turvy without any liquid running out; but, that you may shake them to any extent without causing acid to spill or splash, as the cells are not filled above the level of the active matter, which, with the box, porous plates, &c., forms a solid body.

The internal resistance of a 1 H.P. cell is from $\frac{1}{100}$ to $\frac{1}{150}$ of an Ohm; the resistance of the old experimental cells is about $\frac{1}{200}$ of an Ohm. This is very low, as, in a distribution system, the batteries would very seldom be worked up to their full ampère discharge capacity, as it is always advisable to have a sufficient store of electricity in the houses for several nights' lighting, so that the employés might have the usual holidays, and also as a safety in case of breakage of machinery.

Apologising for occupying so much of your valuable space.

H. T. Barnett.

St. John's Wood,
January 12*th*, 1884.

Protection from Lightning.

I was pleased to see in your last issue the favourable notice of my idea for testing lightning conductors, which "Musicus" addressed to you, and with your permission I will draw attention to the second claim in my specification, which aims at providing a testing wire for conductors already fixed, and the fixing of new ones with an open testing wire, where desired, insulated up the chimney shaft or building by ordinary porcelain supports. This, to my mind, is superior to the method recommended by your correspondent, as the sending a current up an uninsulated wire would be to invite loss by leakage, and so reduce the value of the test, to say nothing of possible short-circuiting from other causes than that of metallic supporting bands so often placed upon chimneys. Besides, the plan of "Musicus" would require double sets of holdfasts, &c. Insulators, however, are decidedly objectionable, and the remedy rather lies in endeavouring to perfect the insulation of the testing wire, a matter which the manufacturers of my patent conductor are paying careful attention to. The following is the second claim in my specification, 3925, 1880:—"The employment for testing purposes of an exterior wire (as distinguished from an internal wire within the cable) insulated in the ordinary way . . . . . connected metallically at the top of an ordinary lightning conductor, and serving the same purpose, and being operated in the same manner as the wire set within the core of a cable, &c."

I would like to add a word or two next week as to the apparatus used for testing conductors.

Samuel Vyle.

4, New Broad Street, London, E.C.
January 15*th*, 1884.

As sole manufacturers of Vyle's patent easily tested lightning conductor, we ask you to kindly grant us space to reply to your correspondent "Musicus." Referring to his suggestion of a double conductor, the late Sir C. W. Siemens not only proposed such an arrangement but had one erected upon a chimney at the Charlton Works; the ropes were not placed alongside each other and were therefore not convenient for readily obtaining a test, had they been arranged as proposed by "Musicus" and joined up in the same way only one earth connection would have been required, which would have effected a saving in the cost, an item unfortunately of first importance with many who have the supplying of these safeguards to property. Vyle's system, however, supplies all that can be obtained by both the above arrangements without any additional cost over the old type of conductor, but your correspondent seems to have a doubt about the insulation of the test wire, we do not think there is any need of fear on that score, we not only insulate the wire as perfectly as is possible, but the material used is such that it will not readily be destroyed by excessive heat. We certainly had misgivings at first whether the insulating materials then used would stand the heat at the top of a furnace chimney, we have however had no failures, and are therefore satisfied if the old insulation stands good that was at first used, we have no fear with what we are now using.

We are now making the patent easily-tested conductor in tape form, with a groove down the centre to receive the test wire, which meets the objection some people have to the appearance of rope.

Dixon & Corbitt.

Teams Rope Works, Gateshead-on-Tyne.
January 14th, 1884.

Faure-Sellon-Volckmar Accumulators.

In your issue of to-day you remark, in connection with a lecture to be delivered by Mr. A. Reckenzaun on the 16th inst.:—"The Faure-Sellon-Volckmar accumulators are apparently withdrawn from the market."

As it is possible that this statement, if allowed to remain uncontradicted, might be detrimental to the interests of this company, permit me to say that it is quite incorrect. The mistake is perhaps due to the fact that a new, or rather a special, type of the F. S. V. accumulator is in course of preparation, but this company have neither the intention nor the wish to abandon the present type, which, on the contrary, is being much improved, and is being manufactured and supplied in large quantities.

T. M. Collet,
General Manager.

Electrical Power Storage Company, Limited,
4, Great Winchester Street, London, E.C.,
January 12*th*, 1884.